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AUTHOR	Flynn, Donald L.
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ABSTRACT

This report examines in detail the cost-estimating model developed for a study of reading-program costs, undertaken as part of a large-scale evaluation of compensatory reading programs. Results of the cost-analysis were presented in a separate report. Here, the confidence which can be placed in the cost-assessment model is evaluated in terms of the probable effects of erroneous allocation rules, missing data, and measurement or data-collection errors. The range of probable error in the analyses is judged to be within an acceptable range for cost-estimation studies. A final chapter makes recommendations to improve future data-collection instruments in an attempt to reduce model sensitivity and measurement error. (AA)

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RMC Report

UR-231

AN EVALUATION OF THE COST EFFECTIVENESS OF ALTERNATIVE COMPENSATORY READING PROGRAMS

Final Report in Four Volumes

Volume II: Model Sensitivity

Donald L. Flynn

April 1976

Prepared for

Educational Testing Service
Princeton, New Jersey

Home Office: 7910 Woodmont Avenue, Bethesda, Maryland 20014
Other Offices: 2570 West El Camino Real, Mountain View, California 94040
12011 San Vicente Boulevard, Los Angeles, California 90049

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SUMMARY

Volume II examines the cost-estimating model developed in Volume I of this study to determine the confidence that can be placed in it and its underlying assumptions. This volume is part of a study of the cost and cost-effectiveness of alternative compensatory reading programs by RMC Research Corporation. This study is part of a large-scale evaluation of compensatory reading programs conducted by the Educational Testing Service (ETS) for the U.S. Office of Education.

The evaluation study involved a comprehensive examination of compensatory reading programs in 256 public schools across the nation during the 1972-73 school year. For this study, compensatory reading programs were defined as reading instruction given to pupils because they were reading below grade level.

Of the total schools involved in the study, approximately 126 schools had compensatory reading programs funded by ESEA Title I, 80 had compensatory reading programs funded from sources other than ESEA Title I, and 30 had no identified compensatory reading programs. The remaining schools (approximately 34, 28 of which were funded by ESEA Title I) were included because they were considered to be exemplary programs.

In each school, all students in the second, fourth, and sixth grades were given special pre- and post-tests to determine reading achievement and changes in attitude during the school year. Detailed attendance records were kept of pupil participation in reading classes. In addition, the principal and all teachers of students in the affected grades completed questionnaires describing the demographic characteristics of the students and their own approaches to teaching. Finally, the principal completed a questionnaire that identified and enumerated the resources in the schools.

RMC's responsibility in this study was to first estimate the cost of the individual programs. Then, using measures of program effectiveness developed by ETS, RMC evaluated the cost-effectiveness of each program.

The results of RMC's work are presented in four volumes, each of which is described below:

- Volume I: Cost Analysis--this volume develops and uses the methodology for estimating the cost of compensatory reading programs. The resulting cost estimates are presented and analyzed.
- Volume II: Model Sensitivity--this volume examines the methodology developed in volume I to assess the impact of alternative cost allocation rules and to measure errors.
- Volume III: Cost-Effectiveness Analysis--this volume examines the cost-effectiveness of alternative compensatory reading programs using the costs developed in Volume I.
- Volume IV: Cost and Cost-Effectiveness Analysis of Summer Programs--this volume uses the procedures and methodologies developed in the first three volumes to conduct an independent examination of summer programs.

This summary describes the reasons for the examination of model sensitivity and outlines the results and conclusions.

PURPOSE OF EXAMINATION

Most previous cost studies of education have relied on budget reports from the individual schools as the primary data source for estimating costs. However, these budget-based estimations have proved to be inadequate for comparing alternative programs--primarily because the varied accounting procedures used by the school districts make it difficult to compare costs. Further, such budgets generally do not highlight the concentrations of the resources being examined. Finally, because budgetary costs only indicate the current year's expenses, they neglect the value of resources inherited from previous years and distort the costs by including one-time capital expenditures.

The method adopted in this study, called the resource approach, is based on a rigorous assessment of the resources (i.e., staff, facilities, equipment, and materials) that were actually used in alternative compensatory reading programs. Specific attention was given to identifying where and how resources were concentrated by collecting all data at the classroom level. To make the costs truly comparable, regional variations were eliminated by using average national values as the standardized resource costs (e.g., teacher salaries).

This level of detail required the collection of a great deal of resource data concerning the quantity and use of the various resources in each school. To properly estimate the cost, a complex cost-estimating model was developed to allocate the resources known to be in a school to the individual classrooms, depending on their use. While every effort was made to accurately accomplish these ends, it is possible that certain errors were incorporated into the model that might lead to erroneous conclusions in the cost-effectiveness analysis.

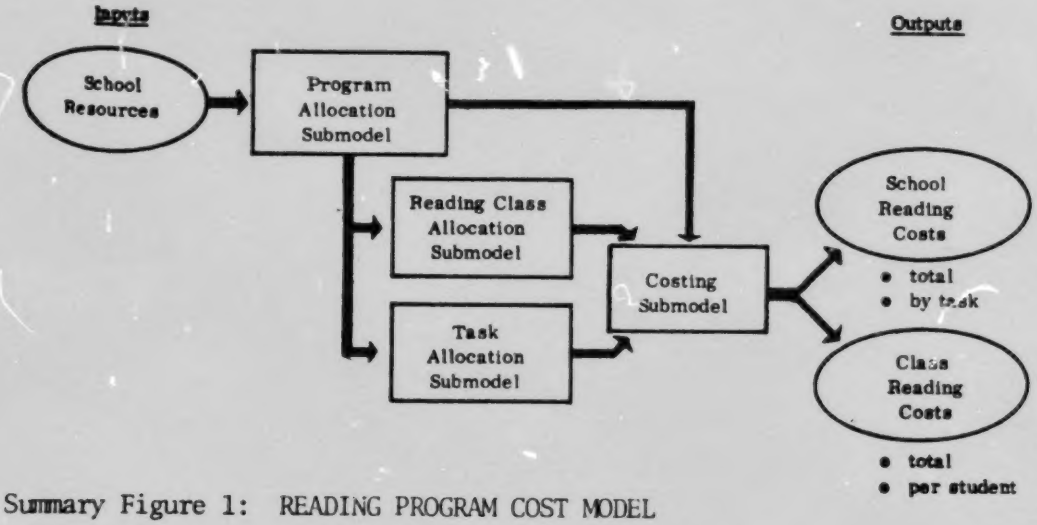
The three general areas in which potential errors might have been incorporated into the model are

- erroneous allocation rules in the model,
- missing data, and
- measurement errors or errors associated with the data collection.

These areas will be separately examined after a short discussion of the cost-estimating model.

COST-ESTIMATING MODEL

The cost-estimating model, which is graphically depicted in Summary Figure 1, consists of four submodels and a series of inputs and outputs.



Summary Figure 1: READING PROGRAM COST MODEL

Although a more complete description of the model can be found in Volume I of this report, it is important to summarize its operations here. First, the model identified the total quantity of each resource available in the

school (n). The program allocation model then determined the proportion of this quantity that was actually available for reading. It accomplished this through the use of a program allocation factor (p). The reading class allocation submodel then allocated the quantity of school reading resources to each individual reading classroom through the use of a reading class allocation factor (r). Similarly, the use of a task allocation factor (t) in the task allocation submodel estimated the quantity of each school reading resource used for each education task (i.e., instruction, diagnosis, staff development, and administration). Finally, the costing submodel determined the cost of this resource at each level of analysis (i.e., school, class, task) by multiplying the previously calculated quantities of the resources that were available at each level by the unit cost of the resource (c). By unit cost, we mean the cost of a single unit of a resource, such as the annual salary of a teacher aide.

In its simplest form, this model can be expressed as the product of all the terms. For example, the cost of a particular resource used in a particular reading class (CRC) is estimated by the equation shown below:

$$CRC = nprc,$$

where n, p, r, and c are uniquely defined for the resources and reading class under consideration.

It is obvious that, in reality, the model is based on a series of allocation factors that attempt to explain how the school resources are used by the various programs and classes with a school. Because of the analytic nature of the model and the large number of observations involved, determination of the factors had to be made using a more or less rigid set of decision rules for allocating the resources. While every attempt was made to establish realistic decision rules, it was impossible to design them in a way that would accurately describe all possible situations. In addition, other concerns affected the design of the decision rules. Because of the large and complex nature of the computational procedures in the model, certain decision rules were made to simplify the required calculations.

In the design and construction of analytical models, situations often arise where no clear-cut consensus is available for guidance. Under such situations, there is really no "correct" answer, only opinions. When such a situation occurs, the best procedure is to examine the sensitivity of the model to changes in the allocation decision rules. In essence, the results are calculated twice, using both decision rules, and the

differences between the two results are examined. If the two results are not significantly different, then the model is not sensitive to changes in the allocation rule. For all practical purposes, the alternative decision rule could then be ignored. Even if the model output is significantly affected by such a change, and is thus sensitive to that change, there still may not be cause for concern. Although the average difference between alternative results may be significantly large, if the variation of this difference is small, a high correlation exists between the two results. Thus, the differences are easy to explain, and they are predictable, allowing the examination of the impact of these differences on subsequent analysis.

SENSITIVITY ANALYSIS

A total of 26 separate investigations were performed to test the sensitivity of 12 different decision rules embedded in the cost-estimating model. These 26 investigations, which are shown below, were derived from examination of the model.

(1) Classes with ten or fewer students are charged with one-half of the facilities cost of other classes.

(2) A teacher is assumed to be available 35 hours per week.

(2) A teacher is assumed to be available 25 hours per week.

(3) Teachers who improperly answered the question regarding reading instruction time are eliminated.

(4a) Seven percent of all administrative cost is allocated to the reading program.

(4b) Administrative cost is eliminated from the reading program.

(5) Teachers of supplemental reading classes are called reading specialists rather than instructors.

(6) Reading specialists completing questionnaires are allocated to classes independent of the number of students.

(7) Reading specialists not completing questionnaires are allocated only to compensatory classes.

(8a) Principals are allocated to classes independent of the number of students.

(8b) Library costs are allocated to classes independent of the number of students.

(9a) Resources used by several classes are shared on a 20:10:1:0 basis, depending on an indicated use of often, sometimes, rarely, and never.

(9b) Resources used by several classes are shared on a 20:5:1:0 basis, depending on an indicated use of often, sometimes, rarely, and never.

(10) Reading specialists are assumed to use reading resources four times more often than regular teachers.

(11a) All staff salaries are increased by 10 percent.

(11b) All staff salaries are reduced by 10 percent.

(11c) Teacher salaries are increased by 10 percent.

(11d) Teacher salaries are reduced by 10 percent.

(11e) Salaries of reading specialists who did not complete questionnaires are increased 10 percent.

(11f) A discount factor of 5 percent is used.

(11g) The useful life of equipment is 30 percent longer.

(12a) The administrative task factor of non-administrative staff is reduced by 15 percent.

(12b) The diagnosis task factor of a class instructor is increased to 0.20, with a corresponding reduction in the instruction factor.

(12c) The diagnosis task factor for a diagnostic reading specialist is increased to 0.75, with a corresponding reduction in the instruction factor.

(12d) The training task factor for a diagnostic and training reading specialist is increased to 0.45, with a corresponding reduction in the instruction factor.

(12e) The cost of all administrative staff is eliminated.

To summarize the results of these 26 investigations, the sensitivity analysis generally showed that changes in the decision rules produce substantial changes in the cost estimates of the cost categories most affected. However, the correlation between the original values and the new values is high, with the coefficient of determination generally in excess of 0.9. Such high correlations allow corrections to be made in the cost-effectiveness analysis that will compensate for these changes. When the total cost of providing reading instruction is examined, changes in the decision rules do not appear to produce significant changes in total cost. The changes that do result are generally less than the variability expected in the results as a result of measurement error. Similar to the new component costs, the correlation between the original total cost and the new total cost is high, with the coefficient of determination greater than 0.99.

In addition to the results summarized above, the following three observations were made concerning the sensitivity of the model to changes in the decision rules:

(1) Reading specialists who completed the Program and Class Characteristics Questionnaire should have been treated as reading specialists rather than as class instructors, as was done in the model described in Volume I of this report. Such a change allows greater comparability to reading specialists who did not complete questionnaires. This change was incorporated into the cost estimates used in the cost-effectiveness analysis described in Volume III of this report. The change produced changes in the average cost of the class instructor and the reading specialist. However, the average total cost remained unchanged.

(2) If reading specialists who did not complete questionnaires are allocated only to compensatory reading classes, significant differences occur in the resulting cost estimates. However, the available information indicated that such reading specialists were not allocated in this manner, and they were therefore uniformly allocated to all classes by the cost-estimating model.

(3) The elimination of the cost of administrative staff, such as supervisors, principals, and secretaries, significantly affects the proportion of the cost allocated to the various tasks. Thus, special consideration was given to using administrative costs in the cost-effectiveness analysis.

MISSING DATA

It is not uncommon for individuals to leave particular questions on a questionnaire blank, either because they did not understand the question or they overlooked it. Because of the large number of inputs required to calculate costs for each reading class, it is likely that at least one of these inputs will be missing. If no attempt was made to replace the missing data, a significant number of observations would be lost for future analysis. For this reason, average values were computed and inserted for all missing inputs.

The use of average values for missing observations is often the accepted technique for situations where missing data would preclude further analysis. It is used because the sample mean value of the observations is unaffected by such replacements. However, this procedure is based on the assumption that the missing observations are not significantly different from the observations where data were obtained. To properly evaluate this assumption, it is necessary to identify the magnitude of the missing data problem. As pointed out in the discussion of the cost-estimating model, three factors

are essential to the model: quantity (n), the program allocation factor (p), and the reading class factor (r). An estimate of the nonresponse rate for each of these three factors for selected resources is presented in Summary Table 1.

Summary Table 1

NONRESPONSE RATES

Resource	Percent Nonresponse Rate		
	Quantity	Program Factor	Classroom Factor
Class Instructors	0	1.16	N/A
Teacher Aides	.41	7.32	9.15
Reading Specialists	.89	4.46	N/A
Other Special Teachers	2.02	6.85	10.56
Nonteaching Academic Staff	3.89	4.12	10.54
Nonteaching Non-Academic Staff	2.12	3.54	10.56
Tape Recorders	1.76	3.87	3.22
Record Players	1.76	3.87	3.22
Movie Projectors	1.82	5.84	2.66
Filmstrip Projectors	1.82	5.84	2.56
Slide Projectors	1.55	3.56	4.85
Opaque Projectors	1.55	3.56	4.85
Overhead Projectors	1.55	3.56	4.85
Televisions	1.37	7.31	6.14
Teaching Machines	3.06	1.41	8.03
Basal Readers	2.44	0	2.23
Individual Reading Kits	7.56	0	6.57
Library Books	1.21	0	N/A

After inspecting Summary Table 1, it is obvious that, in general, the nonresponse rate was less than 10 percent. Because more than 90 percent of the required responses were generally available, it is unlikely that there is much difference between the responses and the nonresponses. Even if there were, the use of averages for the relatively small number of nonresponses should not significantly affect the final cost estimates.

MEASUREMENT ERROR

Even though individuals may not purposefully answer questions incorrectly when they are completing questionnaires, there may be errors associated with the data. These errors, called measurement errors, result from a variety of factors. The respondent may only know the approximate answer to the question. He may not fully understand the question. The available responses,

particularly for subjective questions (i.e., responses of often, sometimes, never), may be sufficiently vague to cause their interpretation to vary from one respondent to another. Finally, while the respondent may accurately describe the situation at the time the question is asked, the situation may change over time. These errors tend to contribute to the uncertainty associated with the results.

In the basic cost equation, five variables were used in estimating the cost: quantity (n), program factor (p), class factor (r), task factor (t), and standardized cost (c). Two of these variables, task factor and standardized cost, were not directly addressed in the various questionnaires. They resulted from other sources and did not vary between schools. Thus, it is possible to consider that no measurement errors are associated with their use.

The remaining three variables are subject to measurement errors because they were determined directly from the questionnaires. It is possible to consider the actual answer to a question as a random response chosen from a distribution about a true value. Of course, the true value varies from school to school and class to class, but an uncertainty is associated with each response. This uncertainty can be small, as in the case of quantitative questions (such as the quantity of tape recorders), or quite large, as in the case of qualitative questions (such as the use of tape recorders). Unfortunately, it is nearly impossible to evaluate the true measurement error because of the many imponderables associated with the data. However, a reasonable value can be estimated based on judgment and an examination of the data using error analysis techniques.

The results of such an analysis are presented in Summary Table 2. The conclusions that can be drawn from this table indicate that the errors associated with the estimation of the cost of particular resources should generally not exceed 10 percent of the indicated value under average conditions. Even under extreme conditions, the costs should be within 15 to 20 percent of the indicated value. The only major exception to this statement is the cost estimates associated with equipment, which could be off by as much as one-third or more under extreme conditions. This is particularly true for pieces of equipment with limited use in the reading program such as televisions. However, the impact of this inaccuracy on the total cost is not important because of the low cost of equipment. The error associated with the cost of groups of resources (e.g., all staff) should usually be around 10 percent.

Summary Table 2

IMPACT OF ERROR ON TOTAL COSTS

Resource	Mean	Standard Error of Estimate[a]	Maximum Error[b] as a Percent of Mean
Class Instructors	107.01	8.5	17.1
Teacher Aides	12.20	8.3	16.6
Reading Specialists	20.99	7.4	14.7
Other Staff	24.80	8.2	16.3
All Staff	165.00	5.5	11.0
Facilities	50.86	8.5	17.1
Equipment	4.16	17.3	34.6
Materials	14.06	6.6	13.2
District Centers	4.71	8.5	17.1
Total Costs	238.79	4.4	8.8

a. Expressed as a percent of the mean. Approximately 68 percent of the observations will be in this range.

b. Expressed as a percent of the mean. Approximately 95 percent of the observations will be in this range.

REDESIGN OF DATA COLLECTION INSTRUMENTS

As the final chapter of this volume, several recommendations have been made to improve future data collection instruments in an attempt to reduce model sensitivity and measurement error. Although the questionnaires developed for this study will probably never be used again, they may serve as a point of departure in future designs. In general, the recommended changes involve asking more specific and quantitative questions regarding the use of resources than were asked in the questionnaires for this study. It is recommended that a total of 20 questions be changed in the Program and Class Characteristics Questionnaire designed by ETS and the Resource Questionnaire designed by RMC.

1

INTRODUCTION

SCOPE AND STUDY OBJECTIVES

This report is the second volume of a four-volume study of the cost effectiveness of alternative compensatory reading programs. The overall study was designed to complement and support a large-scale evaluation of such programs by the Educational Testing Service (ETS) for the U.S. Office of Education. Volume I of this study presented the results of a detailed study of reading program costs at selected elementary schools throughout the country. These costs are integrated with the program outcomes in Volume III of this study in a cost-effectiveness evaluation.

As part of the cost analysis described in Volume I, a complex cost-estimating model was developed. This report examines that model to determine the confidence that can be placed in it and its underlying assumptions and to estimate the uncertainty associated with its estimates.

BACKGROUND OF ETS STUDY

In July 1971, ETS began a survey of public elementary schools and selected features of their reading programs. The study had three phases. The first phase involved a descriptive and analytical study of reading programs in grades 2, 4, and 6 in 731 schools throughout the United States. Phase II included a comprehensive evaluation of the programs for a sample of 256 of the schools for the 1972-73 school year. The goal was to determine how students benefitted from various reading methods and categories of instruction. In addition, the cost effectiveness of various methods was examined. Phase III involved a similar evaluation of special summer compensatory reading programs in 27 schools during the summer of 1973.

ETS used a number of instruments for recording the necessary data and descriptions of the schools and their reading programs for all phases. The instruments included standardized tests to determine reading achievement and student attitudes toward reading, class attendance records, and principal and teacher questionnaires for collecting program and demographic characteristics. While these questionnaires determined the use of various types of resources (staff, equipment, facilities, and materials) in the reading program, no attempt was made to quantify the amount of resources available to the teachers. For this reason, in October 1972, ETS selected RMC Research Corporation to develop a supplemental resource survey and to actually conduct the cost-analysis and cost-effectiveness evaluations for the Phase II study. Volumes I, II, and III of this report present the results of RMC's contribution to that study. In August 1973, RMC began the cost analysis and cost-effectiveness analysis of the summer programs under Phase III of the study. Volume IV of this report presents the results of the examination of the summer programs.

OVERVIEW OF REPORT

Most previous cost studies of education programs have relied on budget reports from the individual schools as the primary data source in estimating costs. Volume I of this report discusses how inadequate estimates developed in this manner were when comparing alternative programs. Therefore, the resource approach was developed and adopted. This approach concentrates on identifying the actual resources (staff, facilities, equipment, and materials) available in the classroom. This level of detail required that a great deal of resource data be collected concerning the quantity and use of the various resources in each school. Because of the large number of classrooms involved in the study--over 2,000--a complex cost-estimating model had to be developed that would allocate the resources known to be in the school to the individual classrooms, depending on their use. While every effort was made to accurately accomplish these ends, it is entirely possible that certain errors were incorporated into the model that might lead to erroneous conclusions in the cost-effectiveness analysis. This report will identify those potential errors and investigate their impact on the cost estimates resulting from the model.

There are three general areas where potential errors might have been incorporated into the model. These are

- erroneous allocation rules in the model,
- missing data, and
- measurement errors or errors associated with data collection.

Chapter 2 of this report examines the sensitivity of the model to alternative allocation rules, while Chapter 3 examines the impact of both missing data and measurement errors.

Because many of the problems encountered in the design and implementation of the cost-estimating model were caused by weaknesses in the manner in which data were collected, the second major task of this report is to redesign the data collection instruments to overcome these limitations. This will allow us to better prepare for future cost analyses. The redesign of the instruments is discussed in Chapter 4. The appendix presents the detailed results of the sensitivity analyses.

2

MODEL SENSITIVITY ANALYSIS

MODEL DESCRIPTION

The basic approach used to determine costs in the study of compensatory reading programs was to estimate the actual quantity of each resource, including the staff, facilities, equipment, and materials that were available to support the reading program in each school and each reading class. Using the cost of each resource, the total cost of employing the resource for reading was then calculated.

Ideally, the cost estimates should have been based upon direct observations in all classrooms. However, the large number of classrooms--over 2,000 --made this type of examination impractical. For this reason, an analytical model was developed that estimated costs based on data collected by questionnaires and during short site visits. This model, a diagram of which can be found in Figure 1, consists of four submodels and a series of inputs and outputs. Although a more complete description of the model can be found in Volume I of this report, it is important to summarize its operations here. The model first identified the total quantity of each resource available in the school (n). The program allocation submodel then determined the proportion of this quantity that was actually available for reading. It accomplished this through the use of a program allocation factor (p). The reading class allocation submodel then allocated the quantity of school reading resources to each individual reading classroom through the use of a reading class allocation factor (r). Similarly, the use of a task allocation factor (t) in the task allocation submodel estimated the quantity of each school reading resource used for each education task (i.e., instruction, diagnosis, staff development, and administration). Finally, the costing submodel determined the cost of this resource at each level of analysis (i.e., school,

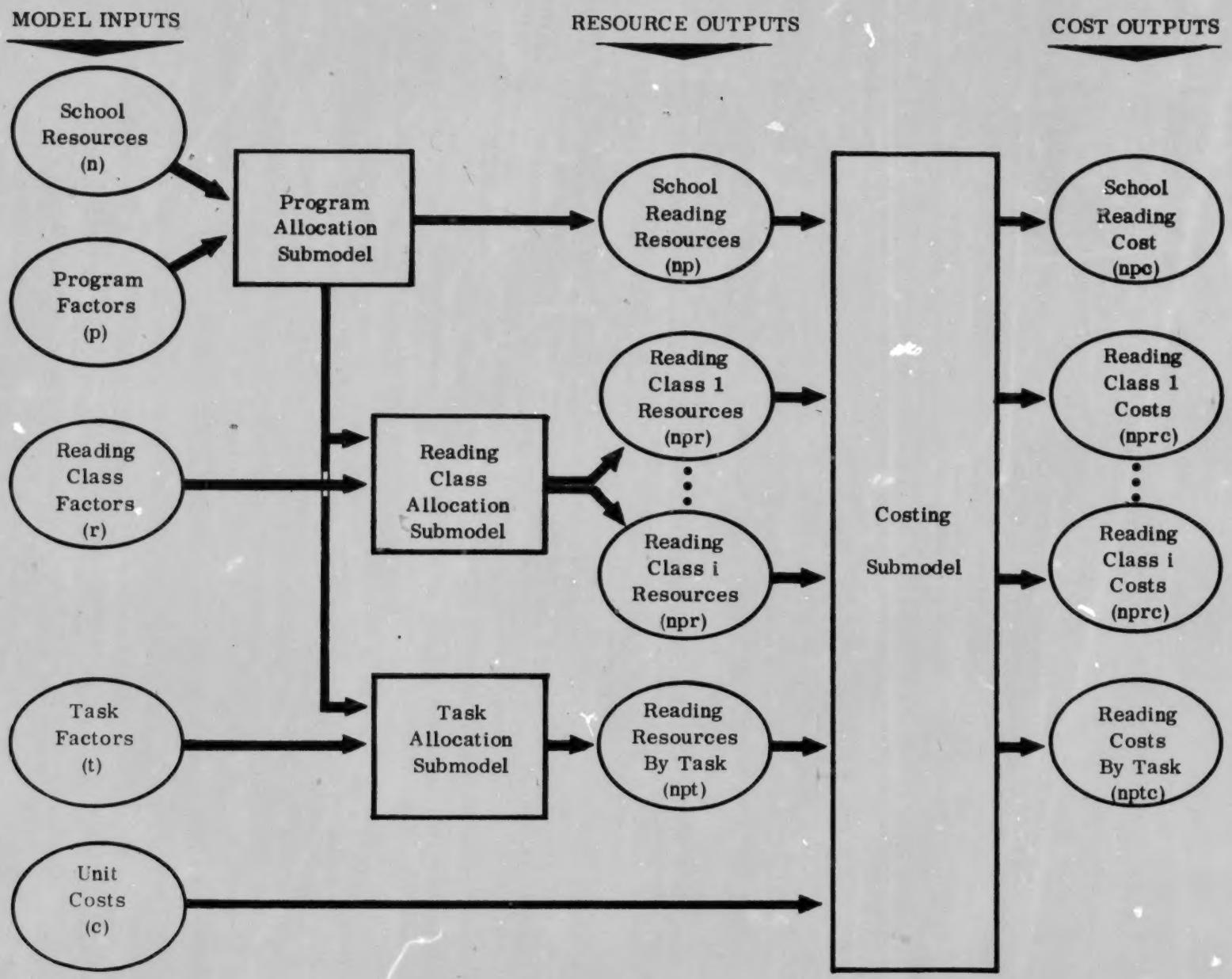


Figure 1: READING PROGRAM COST MODEL

class, task) by multiplying the previously calculated quantities of the resources that were available at each level by the unit cost of the resource (c). By unit cost, we mean the cost of a single unit of a resource, such as the annual salary of a teacher aide. In its simplest form, this model can be expressed as the product of all the terms. For example, the cost of a particular resource used in a particular reading classroom (CRC) is estimated by the following equation:

$$CRC = nprc,$$

where n, p, r, and c are uniquely defined for the resource and reading class under consideration.

The cost estimates that were developed in Volume I of this report were calculated for individual classrooms. The following four descriptors were associated with each classroom: grade, compensatory (developmental), funding source, and cluster. While grade need not be explained further, the other three descriptors do, and they are discussed below.

The principal of each school made a decision about whether each classroom was part of the compensatory reading program. If it was not, the classroom was designated as a developmental reading class.

In an effort to examine the impact of ESEA Title I funds on the success of the compensatory reading program in each school, the source of the funds supporting the program was identified. Three classifications were used: total ESEA Title I funding, partial ESEA Title I funding, and no ESEA Title I funding. An unknown category was used for schools where the funding source was not known. Even though developmental reading programs generally do not receive ESEA Title I funding, we wanted to determine if the availability of ESEA Title I funding in a school affected the cost of its developmental reading programs. Therefore, the costs of the compensatory reading programs in schools with ESEA Title I funding were compared with the costs of their developmental reading programs.

In attempting to define a limited number of programs, ETS used factor analysis to identify five program indices that appeared to characterize the programs based on the responses in the Program and Class Characteristics Questionnaire. These indices were (1) emphasis on basic reading activities, (2) use of audiovisual equipment and materials, (3) emphasis on supplementary reading activities, (4) instructional flexibility, and (5) whether or not the compensatory

reading program was offered during time released from other subjects. By examining these five indices for each school, it was possible to group or cluster the schools with similar programs. A complete discussion of this process is included in the first ETS report.[1] The program clusters included ten for compensatory reading programs using the five reading indices, one "conglomerate" cluster for nonclassifiable compensatory programs, and one cluster for all schools with no identified compensatory programs.

IDENTIFICATION OF PROBLEM

It is obvious that, in reality, the model is based on a series of allocation factors that attempt to explain how the school resources are used by the various programs and classes within a school. Because of the analytic nature of the model and the large number of observations involved, determination of the factors had to be made using a more or less rigid set of decision rules for allocating the resources. Every attempt was made to incorporate the available data about the programs and classrooms that were collected in the questionnaires and to make the decision rules as close to reality as possible. However, it was impossible to design decision rules that could accurately describe all the possible situations that were encountered. In addition, other concerns affected the design of the decision rules. Because of the large and complex nature of the computational procedures in the model, certain decision rules were made to simplify the required calculations. For example, principals were allocated to the reading program in proportion to the amount of time the average teacher spent in reading. In some cases, seemingly poor decision rules were used because more substantial data were unavailable. This was true of the allocation rules for reading specialists. Because of the lack of definition as to who was a reading specialist and the serious question about whether or not the reading specialist completed a questionnaire, a comprehensive series of decision rules had to be developed. In all cases, the decision rules that were developed appeared reasonable.

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1. Rubin, Trismen, Wilder, and Yates, A Descriptive and Analytic Study of Compensatory Reading Programs, Educational Testing Service, PR-73-28 (August 1973).

However, other individuals might feel that alternative decision rules are more reasonable and thus more accurate. Unfortunately, there are no statistical techniques for measuring the reasonableness of any decision rule. But it is possible to investigate the differences in cost estimates that result from different allocation rules. This procedure, called sensitivity analysis, will be examined in the next section.

USE OF SENSITIVITY ANALYSIS

In the design and construction of analytical models, situations often arise where no clear-cut consensus is available for guidance. Under such situations, there really is no "correct" answer, only opinions. When such a situation occurs, the best procedure is to examine the sensitivity of the model to changes in the allocation decision rules. In essence, the results are calculated twice, using both decision rules, and the differences between the two results are examined. If the two results are not significantly different, then the model is not sensitive to changes in the allocation rule. For all practical purposes, the alternative decision rule could then be ignored. Even if the model output is significantly affected by such a change, and is thus sensitive to that change, there still may not be cause for concern. Although the average difference between alternative results may be significantly large, if the variation of this difference is small, a high correlation exists between the two results. Thus, the differences are easy to explain, and they are predictable, allowing the examination of the impact of these differences on subsequent analysis.

The use of sensitivity analysis is best demonstrated by an example. As we will discuss in more detail later, we assumed a particular average salary for reading specialists. It is entirely possible that we underestimated the salary of such specialists by as much as 10 percent. It is important to know the sensitivity of the model to this kind of change in input. Not unexpectedly, a 10 percent increase in the salary of a reading specialist produced a 10 percent increase in the cost per student for reading specialists. However, this change in decision rule produced only a 1.6 percent increase in total staff cost and a 1.3 percent increase in total cost. These latter two differences are almost insignificant when either total staff or total cost is being examined. More important, the coefficient of determination (the square of the correlation coefficient) between the results of the two different

salaries was always greater than 0.999. Thus, in any particular school, the impact on cost of increasing the salary of the reading specialist 10 percent can be accurately predicted as either 10, 1.6, or 1.3 percent higher, depending upon the base one is discussing.

IMPACT ON COST-EFFECTIVENESS ANALYSIS

If the differences are highly correlated, their impacts on the cost effectiveness can also be easily described. As will be discussed in more detail in Volume III of this report, Cost-Effectiveness Analysis, linear regression techniques will be used to investigate the relationships between cost and effectiveness, using the following functional form:

$$E = b_o + \sum_i b_i X_i + \varepsilon,$$

where E = program effectiveness,
X_i = cost of various resources,
b_o = effectiveness intercept,
b_i = regression coefficients, and
ε = error.

Regression analysis, using the observations from each classroom, determines the regression coefficients so that $\Sigma\varepsilon^2$ is minimized. Assume that an analysis was done that related effectiveness to the cost of reading specialists, or

$$E = b_o + b_1 X_1,$$

where X_1 = cost of reading specialists. In essence, b_1 is the incremental increase in effectiveness if one dollar more is spent for more reading specialists. This does not mean that salaries could be increased to increase program effectiveness, but that effectiveness could be produced by purchasing the additional services of a reading specialist. However, as we postulated above, we might have underestimated the salary of reading specialists. Thus, the coefficient b_1 is no longer an accurate measure of the cost effectiveness of reading specialists. A simple transformation can be made to this equation because of the high correlation between the results of the two decision rules. Assume the new equation is of the form

$$E = b_o + b_1' X_1',$$

where $X_1' = 1.1X_1$ because of the underestimation. Solving the equations:

$$b_o + b_1' X_1' = b_o + b_1 X_1$$

$$b_1' (1.1X_1) = b_1 X_1$$

$$b_1' = b_1/1.1,$$

or:

$$E = b_o + \frac{b_1}{1.1} X_1.$$

Thus, if the cost of a reading specialist had been overestimated, a corresponding overestimation of its cost effectiveness was made. As demonstrated above, however, this overestimation is again predictable. More important, the statistical significance attached to the fact that a relationship exists between effectiveness and the use of reading specialists is unaffected by the exact salary used. Thus, while the cost estimates resulting from the cost model are somewhat sensitive to the salary level, the impact on the conclusions resulting from the final cost-effectiveness analysis is minimal.

ANALYTICAL PROCEDURE

The analytical procedure for performing a sensitivity analysis of a model is relatively simple. For each alternative decision rule that is to be examined, a modification is made to the cost-estimating model that incorporates the new decision rule. The complete model is then exercised using the new decision rule. The new cost estimates from the modified model are then compared with the original cost estimates. As described above, this comparison is based on an examination of both the difference and the correlation coefficient between the two estimates.

A computer program was developed to compare the two outputs for each major cost category and for both compensatory and developmental classes. In addition, it was possible to perform the comparison considering the impact of clusters and funding sources. No distinction was made between grades because the previous work had shown no significant difference in the cost of compensatory classes between grades. While the staff and facilities costs for developmental classes were statistically lower for the higher grades, the differences were not great. Four separate terms were calculated to serve as

the basis for comparison. First, the new mean value was calculated for each cost category. The calculation of this mean considered all observations, even those that had no cost in the given cost category. This new mean is directly comparable to mean values calculated for the original model, presented in Table 4-4 of Volume I of this report. Second, the percentage difference between the two costs was calculated, using the following equation:

$$\% \text{ Difference} = \frac{\text{New Cost - Old Cost}}{\text{Old Cost}} \times 100.$$

The percentage differences were averaged across each observation. In addition, the standard deviation (SD) of this percentage difference was also calculated. Unlike the new mean calculation, however--which included all observations--the percentage difference and its standard deviation were only calculated using observations for which the old costs were not zero. The impossibility of calculating a percentage difference for observations where the old cost was zero is obvious by inspection of the above equation. While this impossibility could have been eliminated through a different formulation of the equation, it was desirable to eliminate observations with zero cost for other reasons. Since the sensitivity analysis was designed to highlight the impact of changes on cost due to different decision rules, the inclusion of observations with zero cost (which would generally remain unchanged at zero) would only reduce the apparent percentage difference and cause bias. Finally, the coefficient of determination was calculated for all observations. This coefficient is best defined as the ratio of the amount of the variation of the difference that can be explained by the values of the old cost divided by the total variation of the difference. The higher this ratio, the more closely related the old and new costs are.

In addition to these four terms, which were calculated for all major cost categories, a special examination was made of the total cost. Here, the range of new total cost and percentage differences is presented, along with first, second, and third quartiles. These quartiles are also comparable to those presented in Table 4-4 of Volume I of this report. The corresponding percentage differences are presented for each of these quartiles.

EXAMINATIONS CONDUCTED

A total of 26 separate investigations were performed to test the sensitivity of 12 different decision rules. These 12 decision rules are identified below, along with the particular examinations that were performed.

1. Class Size and Facilities. The model assumes that each class instructor has the same size classroom when calculating facilities cost, regardless of the number of students in the class. This is sometimes not true. To investigate the impact of this assumption, teachers with ten or fewer students will be considered as having a classroom one-half the size of the regular classroom.

2. Total Classrooms. A basic assumption employed in the model was that classroom teachers were in the classroom a total of 30 hours a week (6 hours a day). The procedure for calculating the reading program allocation factor for regular teachers (Types 1 and 2, as described in Volume I) made use of this assumption. The allocation factor was calculated as the number of hours of reading the teacher taught a week divided by the 30 hours per week he was in the classroom. It is true, however, that most teachers are required to be in school a total of 35 hours per week. This additional time is generally for administrative or planning activities, and thus was not considered when calculating the program factor. Because the total salary of a teacher is used, part of this administrative time is included in the cost of the reading program. This administrative cost is identified through the use of the task factors. If, however, the full 35 hours that a teacher is in school is used in the calculation, the percentage of the time spent in reading is proportionally less, with a corresponding reduction in cost. The sensitivity of the output to this change will be investigated. On the other hand, if it is correct that the administrative time should not be included, as was done in the model, it is conceivable that some teachers spend even more time on administrative duties. Thus, the sensitivity of the output to the assumption that a teacher is in the classroom only 25 hours per week will also be tested.

3. Improper Indication of Length of Reading Instruction. Some regular classroom teachers appeared to misunderstand the question regarding the length of the reading period. When this happened, that teacher was assigned a higher value based on other questions in the questionnaire. Because of the critical nature of this question, this may not be a correct technique to use. To check its impact, these teachers will be eliminated from the calculations, and the results calculated without these teachers will be compared with the original results.

4. Administrative Costs. Truly administrative personnel, such as superintendents, directors, principals, and secretaries, are allocated to the reading program in proportion to the time the classroom teacher spends teaching reading. This may tend to overestimate the importance of such administrative personnel in the reading program. To investigate the impact of decreasing this importance, a sensitivity analysis will be performed where a constant 7 percent of the cost of

such personnel will be allocated to the reading program. A second analysis will be performed where none of the costs of these personnel will be included in the cost of the reading program.

5. Classes Taught by Reading Specialists. When a reading specialist completed a Program and Class Characteristics Questionnaire, she was identified with a particular class. When this occurred, the cost-estimating model classified the specialist as a class instructor rather than a reading specialist. However, reading specialists who did not complete questionnaires were uniformly allocated to classrooms as reading specialists. Thus, there are different procedures for allocating reading specialists. However, in the cost-effectiveness analyses, a better basis of comparison would be formed by transferring the cost of the reading specialist who completed a questionnaire from the class instructor category to the reading specialist category. The cost of the class instructor for that class would be set to zero. The impact of this change will be investigated by a sensitivity analysis. It should be recalled that it was possible to identify the special nature of this type of class because the students in this class also appeared in other classes (see Appendix B of Volume I of this report). Thus, the students in this type of class receive instruction in two separate classes, and the total cost of reading instruction should be the sum of the cost of both classes. This computation will be performed for the cost-effectiveness analyses conducted later. However, no sensitivity analysis of this procedure will be conducted here.

6. Allocation of Reading Specialists to Special Reading Classes. Reading specialists who completed questionnaires were uniformly allocated to their students. This allocation rule resulted in the same cost for all students that were taught. The decision rule is based on the assumption that the specialist spends the same amount of time with all students. This may not be a reasonable assumption, considering that the size of classes sometimes varies, while the length of the class generally does not. To investigate this decision rule, an alternative rule will be used where cost will be uniformly allocated to the reading classes independent of the number of students.

7. Allocation of Reading Specialists to Regular Classes. Reading specialists who did not complete questionnaires were uniformly allocated to all students in the grades they taught--not just the compensatory classes. An investigation will be made to determine the sensitivity of the results to allocating such reading specialists to only the compensatory classes.

8. Uniform Allocation to Classes Rather Than Students. Resources uniformly shared by all classes were uniformly allocated to each student, resulting in the same cost for all students. Because resources are generally used by one class at a time and because class size varies between classes, this may not be an appropriate decision rule. A series of sensitivity analyses will be performed to examine the impact of uniformly allocating the costs to the class independent of the size of the class. A separate analysis will be performed for the principal and the library.

9. Changes in Measure of Use Allocation Rule. Resources not uniformly shared are allocated to classes on the basis of a 10:5:1:0 ratio, depending on whether the class instructor indicated that he used the resource often, sometimes, rarely, or never. This basis is very judgmental and open to much discussion. To investigate the impact on the results, alternative ratios of 20:10:1:0 and 20:5:1:0 will be tried in the sensitivity analyses.

10. Reading Specialists and Measures of Use Allocation Rule. As described above, resources not uniformly shared were allocated to classes based on how much the class instructor used the resource in the reading program. Because reading specialists teach reading much more than regular classroom teachers, they are actually likely to use resources for reading much more than regular classroom teachers when both indicate the same use (e.g., often). To correct for this limitation, the specialists' use was multiplied by five in the model. Again, this correction factor is somewhat judgmental. An examination of the results will be performed where this correction factor is changed to four.

11. Changes in Standard Cost. Once the quantity of a reading resource used in a classroom was estimated through the use of the various allocation rules, the cost to this classroom for the resource was determined by multiplying the quantity by a standardized unit cost. There are three potential errors that might be associated with the use of the standard costs. First, the actual standardized cost used, particularly for staff, may not be a reasonable estimate. Second, the discount factor used to amortize capital cost may be incorrect. Finally, the useful life of equipment and materials, also used in amortizing their capital costs, may be inappropriate. To investigate the sensitivity of the output to changes in these areas, a total of seven analyses will be performed:

    (1) The salary of all staff will be increased by 10 percent.

    (2) The salary of all staff will be decreased by 10 percent.

    (3) The salary of classroom teachers will be increased by 10 percent.

    (4) The salary of classroom teachers will be decreased by 10 percent.

    (5) The salary of reading specialists who did not complete questionnaires will be increased by 10 percent.

    (6) A discount factor of 5 percent will be used.

    (7) The useful life of equipment and materials will be increased by 30 percent.

12. Changes in Task Factors. The task factors were developed to give some insight into the amount of emphasis given by various schools to each of the four tasks: instruction, diagnosis, staff development, and administration. Of particular interest will be the fraction of the total cost spent for diagnosis and staff development. The task factors were estimated on an informal basis and thus are open to a great deal of discussion. A series of examinations will be conducted in which the diagnosis and staff development task costs will be compared for different sets of task factors. A total

of five sensitivity analyses will be conducted. These are listed below:

(1) The administrative task factor for all but the truly administrative staff will be reduced by one-third with a proportional increase in the other tasks.

(2) The diagnosis task factor of the classroom teacher will be increased to 0.20, with a corresponding reduction in the instruction task.

(3) The diagnostic reading specialist will have his diagnosis task factor increased to 0.75, with a corresponding reduction in the instruction task.

(4) The diagnostic and training reading specialist will have the training factor increased to 0.45, with a corresponding decrease in the instruction task.

(5) The cost of all truly administrative duties will be eliminated.

RESULTS AND CONCLUSIONS

The sensitivity analyses described above were all performed considering the distinction between the two costs caused by funding sources. In several instances, the impact of considering program clusters on the cost differences was also investigated. In no case, however, were there statistically significant differences in the bases of comparison when the costs were examined by cluster and funding source, as compared with the examination when clusters and funding sources were ignored. For this reason, only the results for all clusters and funds will be presented.

A summary of the sensitivity analyses conducted on the first 11 decision rules is presented in Tables 1 and 2. A more complete description of the impact of each of the changes in the decision rules can be found in the appendix. Table 1 presents the impact of the change on the most important cost components, while Table 2 presents the impact of the change on total cost. Both tables present the new mean, the average percentage difference, the standard deviation (SD) of this difference, and the coefficient of determination (R^2) for both compensatory and developmental classes. Table 2 also presents the original total cost of both compensatory and developmental classes for comparison purposes.

An examination of Table 1 reveals that, in general, changes in decision rules produce significant changes in the resulting costs of the most sensitive

Table 1

SUMMARY OF SENSITIVITY ANALYSIS: COMPONENT COST PER STUDENT

Sensitivity Analysis	Cost Component	Compensatory Classes				Developmental Classes			
		New Mean	Percent Difference	SD of Difference	R^2	New Mean	Percent Difference	SD of Difference	R^2
1. Classes with ten or fewer students are charged with one-half the facilities cost of other classes.	Facilities	40.48	-9.66	13.26	.878	31.06	-2.25	8.34	.880
2. A teacher is available 35 hours per week.	Instructor	91.72	-10.04	.03	.995	57.00	-14.29	.03	1.000
2. A teacher is available 25 hours per week.	Instructor	128.41	20.01	.05	1.000	79.81	20.00	.05	1.000
3. Teachers who improperly answered question regarding reading instruction time.	Instructor	102.39	-4.17	11.53	.929	62.74	-5.75	23.45	.523
4a. Seven percent of administrative cost is allocated to reading program.	Other Staff	20.56	-24.99	15.42	.968	18.76	-25.71	16.86	.983
4b. Administrative cost is eliminated from reading program.	Other Staff	16.22	-53.58	15.65	.915	14.69	-53.62	11.48	.967
5. Teachers of supplemental reading classes called reading specialists rather than instructors.	Instructor Reading Specialist	52.91 75.08	-22.84 373.98	61.72 473.14	.051 .044	64.57 15.98	-1.15 11.29	9.88 21.37	.647 .657
6. Reading specialists completing questionnaires allocated to classes independent of number of students.	Instructor	107.93	.50	6.24	.987	66.34	-.30	3.50	.997
7. Reading specialist not completing questionnaire allocated only to compensatory classes.	Reading Specialist	62.42	294.39	49.43	.450	1.83	-88.16	83.45	.124
8a. Principals allocated to classes independent of number of students.	Other Staff	25.84	6.50	11.46	.969	21.35	-8.21	10.35	.995
8b. Library allocated to classes independent of number of students.	Materials	16.21	12.19	21.62	.749	12.21	-14.47	16.74	.964
9a. Resources shared on 20:10:1:0 basis.	Teacher Aide Equipment	12.24 4.16	2.32 -.45	11.32 5.123	.990 .998	7.06 3.02	-9.10 -1.45	15.63 9.023	.961 .988
9b. Resources shared on 20:5:1:0 basis.	Teacher Aide Equipment	12.40 4.22	1.53 .38	8.491 12.72	.998 .978	7.93 2.88	-6.60 -4.32	12.63 16.43	.973 .994
10. Reading specialists use resources four times more often than regular teachers.	Teacher Aide Equipment	11.61 4.00	-.39 -.88	7.461 8.28	.991 .974	7.41 3.07	2.35 3.03	6.38 5.999	.992 .995
11a. All staff salaries increased by 10%.	All Staff	181.51	10.00	.03	1.000	121.89	10.00	.03	1.000
11b. All staff salaries reduced by 10%.	All Staff	148.49	-10.00	.24	1.000	99.74	-10.00	.04	1.000
11c. Teacher salaries increased by 10%.	Instructor	117.71	10.00	.03	1.000	73.16	10.00	.03	1.000
11d. Teacher salaries reduced by 10%.	Instructor	96.27	-10.01	.25	1.000	59.85	-10.00	.03	1.000
11e. Salaries of reading specialists who did not complete questionnaires increased 10%.	Reading Specialist	23.09	10.00	.07	1.000	15.45	10.00	.04	1.000
11f. A discount factor of 5 percent was used.	Equipment	4.03	-3.06	.72	1.000	25.20	-3.03	.86	1.000
11g. The useful life of equipment is 30 percent longer.	Equipment	3.88	-6.58	.82	1.000	2.82	-2.13	1.48	1.000

Table 2

SUMMARY OF SENSITIVITY ANALYSIS: TOTAL COST PER STUDENT

Sensitivity Analysis	Compensatory Classes				Developmental Classes			
	New Mean	Percent Difference	SD of Difference	R^2	New Mean	Percent Difference	SD of Difference	R^2
Original Costs	238.79	--	--	--	164.75	--	--	--
1. Classes with ten or fewer students are charged with one-half the facilities cost of other classes.	228.41	-2.32	4.16	.991	163.63	-.39	1.47	.996
2. A teacher is available 35 hours per week.	222.28	-6.71	1.83	.999	154.10	-6.71	1.57	.999
2. A teacher is available 25 hours per week.	261.91	9.40	2.57	.998	179.66	9.39	2.19	.998
3. Teachers who improperly answered question regarding reading instruction time.	225.13	-4.05	13.25	.858	149.04	-6.36	34.51	.409
4a. Seven percent of administrative cost is allocated to reading program.	234.54	-1.97	1.63	.999	160.77	-2.52	2.00	.998
4b. Administrative cost is eliminated from reading program.	230.21	-4.18	2.63	.997	156.71	-5.21	2.96	.996
5. Teachers of supplemental reading classes called reading specialists rather than instructors.	238.79	0.00	0.00	1.000	164.75	0.00	0.00	1.000
6. Reading specialists completing questionnaires allocated to classes independent of number of students.	240.09	0.31	3.91	.991	164.50	-.11	1.309	.999
7. Reading specialist not completing questionnaire allocated only to compensatory classes.	280.22	23.93	16.74	.823	152.53	-6.40	13.49	.897
8a. Principals allocated to classes independent of number of students.	239.83	.06	1.47	.999	163.37	-.88	1.08	.999
8b. Library allocated to classes independent of number of students.	240.95	.26	3.037	.997	162.77	-1.34	1.99	.999
9a. Resources shared on 20:10:1:0 basis.	238.88	.06	1.70	1.000	164.34	-.29	2.42	1.000
9b. Resources shared on 20:5:1:0 basis.	239.04	.09	.787	1.000	164.47	-.17	1.96	1.000
10. Reading specialists use resources four times more often than regular teachers.	237.85	-.12	1.16	.999	164.79	.17	.95	.998
11a. All staff salaries increased by 10%.	255.29	6.85	0.74	1.000	175.83	6.64	.84	.999
11b. All staff salaries reduced by 10%.	222.28	-6.85	.72	1.000	153.68	-6.66	.83	.999
11c. Teacher salaries increased by 10%.	249.49	4.28	1.35	.999	171.40	4.18	1.08	.999
11d. Teacher salaries reduced by 10%.	228.05	-4.29	1.36	.999	158.09	-4.18	1.08	.999
11e. Salaries of reading specialists who did not complete questionnaires increased 10%.	240.63	0.81	1.31	.999	165.95	.61	1.19	.999
11f. A discount factor of 5 percent was used.	226.80	-4.88	1.29	.999	156.86	-4.95	1.15	.999
11g. The useful life of equipment is 30 percent longer.	236.47	-1.03	.37	1.000	162.91	-1.17	.43	1.000

cost categories. Thus, there is some cause for concern about the accuracy of the decision rules in the model. However, except for several exceptions, the coefficient of determination exceeds 0.88. The new costs are therefore highly correlated; and, as discussed before, corrections can be made in the results of the cost-effectiveness analyses, if necessary.

The exceptions mentioned above include Examinations 3, 5, 7, and 8b. The correlation between both results is excessively low in only two cases: Examination 5, where the instructors of special reading classes are called classroom teachers rather than reading specialists, and Examination 7, where reading specialists are restricted to compensatory classes.

After eliminating developmental teachers who appeared to misunderstand the question regarding instruction time, the correlation between the two results in Examination 3 is low, and the reason for this is not clear. The most probable explanation is that the eliminated classes affected the school average in an erratic manner. It should be remembered that there were statistically significant differences in cost between grades in developmental classes. This analysis demonstrates the critical nature of this information, and stresses the importance of collecting accurate data about program length. However, because the percentage change is less than 7 percent for all cost categories, and because of the probable cause of the difference, there is no need for concern.

The number of students in compensatory classes was generally 5 to 10, while the number in developmental classes averaged 20 to 30. When the cost of the library was evenly distributed to classes--independent of the number of students in the class--as was done in Examination 8b, compensatory classes received a higher portion of the cost than they had before. This is reflected in the results of the analysis. The same type of effect influenced the cost of the principal in Examination 8a. However, because the cost of the principal was reported as part of the other staff cost category, the effect is less pronounced. This examination shows that allocating costs by students rather than by classes has an important impact on the results, at least at the cost subcategories. However, this does not cause any major problems because the percentage changes caused by the examination are approximately 1 percent for the total cost category.

The low result was completely expected for Examination 5. In this situation, the costs of the class instructor were transferred to the cost of the

reading specialist in the special cases where the instructor was more properly called a reading specialist. This allows a more comparable basis when examining reading specialists in the cost-effectiveness examination. As expected by the transfer, the average cost of instructors was greatly reduced, while the average cost of reading specialists was greatly increased. Because this is the basis of comparison that will be used in the later cost-effectiveness evaluation, the new means estimated in the sensitivity analysis are more appropriate when examining the average cost of each cost component. However, there was no impact on total cost.

In Examination 7, the impact of allocating reading specialists who did not complete questionnaires to only the compensatory reading classes had a significant effect. Because the costs are now concentrated in the compensatory classes, which--in addition--are generally smaller than the developmental classes, the cost of reading specialists increased tremendously. Likewise, the cost of reading specialists in developmental classes was reduced almost to zero. Thus, this change in a decision rule has significant impact on the results of the cost analysis. However, there is no reason to believe that reading specialists were allocated to only the compensatory reading classes.

Table 2 shows that, while some significant changes do occur in total cost as a result of these changes in decision rules, these changes are generally less than 10 percent. As will be shown in Chapter 3, the error associated with the data collection (measurement error) is estimated to be on the order of 15 to 20 percent. Thus, the potential errors associated with total cost caused by changes in the model decision rules are fewer than the random errors associated with data collection. Therefore, these errors can almost be ignored. This statement receives even more support from the fact that the coefficient of determination generally exceeds 0.99. As a result, it is entirely reasonable not to be concerned about the impact of these 11 decision rules on total cost.

The previous discussion investigated the impact of the first 11 changes in decision rules on the various components of cost. The last change in decision rules involves changes in the task factors. The task factors were used only on the total school cost, with no distinction made for compensatory or developmental costs. Distinctions were made, however, between cost categories. The task factors allocated the cost of each of the components to

the various tasks accomplished in the school: instruction, diagnosis, staff development, and administration. A summary of the results of the sensitivity analysis of the various changes in task factors is presented in Tables 3 and 4. A more complete description of these results can also be found in the appendix. Table 3 presents the impact of the change on the most important cost components, while Table 4 presents the impact on total cost. Both tables present the percentage of the component cost allocated to the various tasks. For example, Examination 12 on Table 3 indicates that 59.72 percent of the total cost of class instructors can be allocated to instruction, while 17.91 percent can be allocated to the diagnosis of student reading problems. As in Tables 1 and 2, the new means, the average percentage differences, the standard deviations (SD) of these differences, and the coefficients of determination are presented. Table 4 also presents the original percentages of the total cost that were allocated to the various tasks. This serves as a basis of comparison.

Both tables indicate that there are substantial changes in the percentage of the cost allocated to the various tasks. However, with one exception, the coefficient of determination always exceeded 0.99, meaning that there is a very high correlation between the two decision rules. Thus, the impact of any alternative decision rules regarding task factors could be examined without difficulty after the cost-effectiveness analyses are conducted. The one major exception is the elimination of all administrative costs. While this is not truly a change in the task factor decision rules, it has a significant impact on the percentage of cost allocated to each task. This particular change in decision rules was also investigated in Examination 4. There, it was shown that this change produced a 54 percent reduction in other staff costs and a 4 to 5 percent reduction in total cost. This examination indicates that there is a corresponding change in task costs. Primarily, this change is a decrease in the administrative percentage, which is an expected result. There is a corresponding increase in the percentage diagnosis cost for the other staff category and an increase in the percentage instruction cost for the total cost component. If tasks are considered in the cost-effectiveness analysis, consideration should be given to whether or not to include the administrative cost in the analysis.

Table 3

SUMMARY OF SENSITIVITY ANALYSIS: PERCENT OF COMPONENT COST BY TASK

Sensitivity Analysis	Cost Component	Statistic	Instruction	Diagnosis	Staff Development	Administration
12a. The administrative task factor of non-administrative staff reduced by 15 percent.	All Staff	New Mean	59.72	17.91	4.58	17.79
		Percent Diff.	5.70	5.35	2.75	-20.46
		SD of Diff.	.218	.65	1.89	5.55
		R^2	1.000	.999	.999	.997
12b. Diagnosis task factor of class instructor increased to .20, with the reduction in instruction.	Class Instructor	New Mean	64.54	19.96	.68	14.82
		Percent Diff.	-7.14	33.34	.00	.00
		SD of Diff.	.02	.04	.00	.00
		R^2	1.000	1.000	1.000	1.000
12c. Diagnosis task factor for a diagnostic reading specialist increased to .75, with the reduction in instruction.	Reading Specialist	New Mean	48.21	28.72	8.18	14.89
		Percent Diff.	-3.09	.86	.00	.00
		SD of Diff.	11.41	3.41	.00	.00
		R^2	.994	.991	1.000	1.000
12d. Training task factor for a diagnostic and training reading specialist increased to .45, with the reduction in instruction.	Reading Specialist	New Mean	48.54	28.21	8.36	14.89
		Percent Diff.	-.71	.00	.64	.00
		SD of Diff.	3.96	.00	3.48	.00
		R^2	.999	1.00	.991	1.000
12e. The cost of all administrative staff eliminated.	Other Staff	New Mean	23.95	35.12	22.10	18.83
		Percent Diff.	-.97	26.17	-4.86	-73.92
		SD of Diff.	21.42	32.41	34.80	89.21
		R^2	.799	.510	.372	.022

Table 4

SUMMARY OF SENSITIVITY ANALYSIS: PERCENT OF TOTAL COST BY TASK

Sensitivity Analysis	Statistic	Instruction	Diagnosis	Staff Development	Administration
Original Percentages	Old Mean	61.74	14.20	5.41	18.65
12a. The administrative task factor of non-administrative staff reduced by 15 percent.	New Mean	63.91	14.82	5.50	15.77
	Percent Diff.	3.53	4.33	1.51	-16.19
	SD of Diff.	.47	.68	1.24	4.21
	R^2	.998	.999	.999	.991
12b. Diagnosis task factor of class instructor increased to .20, with the reduction in instruction.	New Mean	59.90	15.96	5.41	18.65
	Percent Diff.	-2.85	13.33	.00	.00
	SD of Diff.	.73	5.16	.00	.00
	R^2	.994	.982	1.000	1.000
12c. Diagnosis task factor for a diagnostic reading specialist increased to .75, with the reduction in instruction.	New Mean	61.68	14.26	5.41	18.65
	Percent Diff.	-.13	.29	.00	.00
	SD of Diff.	.80	1.472	.00	.00
	R^2	.997	.993	1.000	1.00
12d. Training task factor for a diagnostic and training reading specialist increased to .45, with the reduction in instruction.	New Mean	61.71	14.20	5.44	18.65
	Percent Diff.	-.05	.00	.29	.00
	SD of Diff.	.30	.00	1.87	.00
	R^2	.999	1.000	.996	1.000
12e. The cost of all administrative staff eliminated.	New Mean	66.36	14.74	4.96	13.94
	Percent Diff.	7.84	3.72	-9.45	-23.23
	SD of Diff.	6.86	4.70	9.77	31.45
	R^2	.703	.975	.958	.295

SUMMARY

To summarize the results presented above, the sensitivity analysis generally showed that changes in the decision rules produce substantial changes in the cost estimates of the cost categories most affected. However, the correlation between the original values and the new values is high, with the coefficient of determination generally in excess of 0.9. As shown in this chapter, the high correlations allow corrections to be made in the cost-effectiveness analysis that will compensate for these changes. When the total cost of providing reading instruction is examined, changes in the decision rules do not appear to produce significant changes in total cost. The changes that do result are generally less than the variability expected in the results as a result of measurement error. Similar to the component costs, the correlation between the original total cost and the new total cost is high, with the coefficient of determination greater than 0.99.

Three major exceptions to this general statement were observed:

(1) Reading specialists who completed the Program and Class Characteristics Questionnaire should be treated as reading specialists rather than class instructors, as was done in the model. This allows greater comparability to reading specialists who did not complete questionnaires. This change produced changes in the average cost of both the class instructor and the reading specialist. The average total cost remained unchanged. This correction will be incorporated into the cost-effectiveness analysis.

(2) If reading specialists who did not complete questionnaires are allocated only to compensatory reading classes, significant differences occur in the resulting cost estimates. However, the available information indicated that such reading specialists were not allocated in this manner, and they were therefore uniformly allocated to all classes by the cost-estimating model.

(3) The elimination of the cost of administrative staff, such as supervisors, principals, and secretaries, will significantly affect the proportion of the cost allocated to the various tasks. Thus, if any cost-effectiveness analysis is to be done using the task costs, special consideration should be given to whether or not administrative costs are used.

3

ERRORS IN DATA

Two types of errors might be associated with the data from this study. The first is the use of grade or school averages as a replacement for missing data. Second, the data actually collected could be in error. This second type of error is called measurement error. Each of these two types of errors will be discussed in detail below.

MISSING DATA

It is not uncommon for individuals to leave particular questions on a questionnaire blank, either because they did not understand the question or they overlooked it. Because of the large number of inputs required to calculate costs for each reading class, it is likely that at least one of these inputs will be missing. If no attempt was made to replace the missing data, a significant number of observations would be lost for future analysis. For this reason, average values were computed and inserted for all missing inputs. In general, these averages were calculated from a sample of observations with characteristics similar to the missing observation. For example, if a teacher failed to indicate how often she used a tape recorder, the average use indicated by teachers in the same grade in her school was used as representative of her use. Since the use or non-use of a resource is generally determined by programs and policies in the school, it is felt that the teacher's use of a resource would be similar to that of her peer group of teachers in the same grade.

This procedure was followed except where the number of missing responses exceeded a reasonable quantity. In the Resource Questionnaire, the amount of missing data was generally minimal. However, four questionnaires were eliminated because the majority of the responses were missing from them. When the Resource Questionnaire was eliminated, the entire school was eliminated from the analysis, even though Program and Class Characteristics Questionnaires

might have been available. Sixteen items were required on the Program and Class Characteristics Questionnaire. If eight or more items were missing, the questionnaire was not used and the classroom was eliminated from the analysis. About 5 percent of the classrooms, or nearly 100, were eliminated in this manner. The impact of eliminating these classes cannot be completely investigated. However, as part of the sensitivity analysis, an additional group of classes was eliminated because it appeared the respondents may have misunderstood a key question. When the results were recalculated, the cost of the average class decreased about 5 percent.

The use of average values for missing observations is often the accepted technique for situations where missing data would preclude further analysis. It is used because the sample mean value of the observations is unaffected by such replacements. However, this procedure is based on the assumption that the missing observations are not significantly different from the observations where data were obtained. To properly evaluate this assumption, it is necessary to identify the magnitude of the missing data problem. Ninety-seven different resources are examined in the cost-estimating model. For each of these resources, three factors that are essential to the model must be determined or calculated. These factors are the quantity (n), the program allocation factor (p), and the reading class factor (r). Chapter 1 of this report presents a more thorough discussion of these terms.

The quantity and program allocation factors were generally determined from items in the Resource Questionnaire. Since there was only one such questionnaire per school, it is relatively easy to determine the percentage of missing responses required for determining these two factors. Table 5 presents this percentage for each factor for all major resources considered. Since an individual is less likely to respond to a particular question when he does not have the particular resource under consideration, these percentages are corrected to consider only those situations where the respondent is known to have the resource but did not respond.

The reading class allocation factor was generally determined from one of the 16 items in the Program and Class Characteristics Questionnaire. Because of the large number of these questionnaires, over 2,000, it was impossible to do an exhaustive count of all the missing data. However, a 50 percent sample was used as a basis for estimating the typical nonresponse rate. These percentages are also presented in Table 5. In several cases, the costs of a resource

Table 5

NONRESPONSE RATES

Resource	Percent Nonresponse Rate		
	Quantity	Program Factor	Classroom Factor
Class Instructors	0	1.16	N/A
Teacher Aides	.41	7.32	9.15
Reading Specialists	.89	4.46	N/A
Other Special Teachers	2.02	6.85	10.56
Nonteaching Academic Staff	3.89	4.12	10.56
Nonteaching Non-Academic Staff	2.12	3.54	10.56
Tape Recorders	1.76	3.87	3.22
Record Players	1.76	3.87	3.22
Move Projectors	1.82	5.84	2.66
Filmstrip Projectors	1.82	5.84	2.66
Slide Projectors	1.55	3.56	4.85
Opaque Projectors	1.55	3.56	4.85
Overhead Projectors	1.55	3.56	4.85
Televisions	1.37	7.31	6.14
Teaching Machines	3.06	1.41	8.03
Basal Readers	2.44	0	2.23
Individual Reading Kits	7.56	0	6.57
Library Books	1.21	0	N/A

were allocated to a classroom using a procedure that did not require data from the teacher. The prime example of this is the library, which was uniformly allocated to all classes. For these resources, the nonresponse rate is not applicable and is so marked. Because of the size of the sample, it was not possible to correct for understandable nonresponse in the situation where the resource was not available. This may explain the relatively high incidence of nonresponse for certain types of staff resources--particularly teacher aides. Because a distinction was made between compensatory and developmental classes when the questionnaires were completed, this distinction was maintained in our analysis of nonresponse. However, because the difference between the two types of classes generally differed by no more than one or two percentage points, the results were averaged in Table 5.

Because of the possibility of multiple nonresponse in the same Program and Class Characteristics Questionnaire, a separate analysis was conducted to determine the percentage of questionnaires where three or more questions were not

answered. Not considering the 5 percent of the questionnaires that were eliminated because they failed to answer eight or more of the questions, a total of approximately 11 percent failed to answer three or more questions. There was a distinction between compensatory and developmental classes in this separate analysis. Approximately 15 percent of the compensatory classes and 7 percent of the developmental classes failed to answer three or more questions. Thus, because of the relatively high percentage of classrooms in this classification as compared with the average nonresponse rate on the individual items, it would appear that the nonresponses tended to occur in the same questionnaire. A visual inspection of the responses supports this hypothesis. In general, those questionnaires with several nonresponses did not cluster in the same school.

After inspecting Table 5, it is obvious that, in general, the nonresponse rate was less than 10 percent. Because more than 90 percent of the required responses were generally available, it is unlikely that there is much difference between the responses and the nonresponses. Even if there were, the use of averages for the relatively small number of nonresponses should not significantly affect the final cost estimates.

MEASUREMENT ERROR

Even though individuals may not purposefully answer questions incorrectly when they are completing questionnaires, there may be errors associated with the collected data. These errors, called measurement errors, result from a variety of factors. The respondent may only know the approximate answer to the question. He may not fully understand the question. The available responses, particularly for subjective questions (i.e., responses of often, sometimes, never), may be sufficiently vague so that their interpretation may vary from one respondent to another. Finally, while the respondent may accurately describe the situation at the time the question is asked, the situation may change over time. These errors tend to contribute to the uncertainty associated with the results. This subtask will investigate these measurement errors and estimate their magnitude.

In the basic cost equation, five variables are used in estimating the cost. They are: quantity (n), program factor (p), class factor (r), task factor (t), and standardized cost (c). Two of these variables, task factors and standardized costs, were not directly addressed in the various questionnaires. They resulted from other sources and did not vary between

schools. Thus, it is possible to consider that no measurement errors are associated with their use. However, this is not to say that there are no potential errors in their use. These errors were discussed in the previous chapter.

The remaining three variables are subject to measurement errors because they are determined directly from the questionnaires. It is possible to consider the actual answer to a question as a random response chosen from a distribution about a true value. Of course, the true value varies from school to school and class to class, but an uncertainty is associated with each response. This uncertainty can be small, as in the case of quantitative questions (such as the quantity of tape recorders), or quite large, as in the case of qualitative questions (such as the use of tape recorders). Unfortunately, it is nearly impossible to evaluate the true measurement error because of the many imponderables associated with the data. However, it is possible to estimate a reasonable value based on judgment and an examination of the data. To evaluate the uncertainty caused by measurement error, eight different types of resources were investigated. These resources were class instructor, teacher aide, reading specialist, psychologist, principal, tape recorder, television, and basal readers. It was felt that these eight different resources are characteristic of all resources considered by the cost-estimating model.

The theoretical basis for evaluating the impact on the cost estimates of measurement errors is best demonstrated by the following mathematical derivation. Assume that there are three independent random variables (X_1, X_2, X_3), each of which has a mean (μ_1, μ_2, μ_3) and a standard deviation of the estimating error (σ_1, σ_2, σ_3). Define a fourth random variable (X_R) that is the product of the first three variables, or

$$X_R = X_1 X_2 X_3.$$

Determine the mean (μ_R) and the standard deviation of its estimating error (σ_R):

$$\mu_R = E(X_1 X_2 X_3) = E(X_1) E(X_2) E(X_3) = \mu_1 \mu_2 \mu_3 \qquad \text{Eq. 1}$$

$$\sigma_R^2 = E[(X_1 X_2 X_3 - \mu_1 \mu_2 \mu_3)^2]$$

$$= E(X_1^2) E(X_2^2) E(X_2^2) - (\mu_1 \mu_2 \mu_3)^2$$

By definition:

$$E(X_i^2) = \sigma_i^2 + \mu_i^2.$$

By substituting, expanding, and combining terms:

$$\sigma_R^2 = (\sigma_1^2 + \mu_1^2)(\sigma_2^2 + \mu_2^2)(\sigma_3^2 + \mu_3^2) - (\mu_1 \mu_2 \mu_3)^2$$

$$= \sigma_1^2 \sigma_2^2 \sigma_3^2 + \mu_1^2 \sigma_2^2 \sigma_3^2 + \mu_2^2 \sigma_1^2 \sigma_3^2 + \mu_3^2 \sigma_1^2 \sigma_2^2 \qquad \text{Eq. 2}$$

$$+ \mu_1^2 \mu_2^2 \sigma_3^2 + \mu_1^2 \mu_3^2 \sigma_2^2 + \mu_2^2 \mu_3^2 \sigma_1^2$$

As will be shown in later tables,

$$\sigma_i^2 \ll \mu_i^2.$$

Thus,

$$\sigma_i^2 \sigma_j^2 \sigma_k^2 \ll \mu_i^2 \sigma_j^2 \sigma_k^2 \ll \mu_i^2 \mu_j^2 \sigma_k^2.$$

When the very small terms are eliminated in equation 2, (i.e., $\sigma_i^2 \sigma_j^2 \sigma_k^2$ and $\mu_i^2 \sigma_j^2 \sigma_k^2$), the following result is obtained:

$$\sigma_R^2 = \mu_1^2 \mu_2^2 \sigma_3^2 + \mu_1^2 \mu_3^2 \sigma_2^2 + \mu_2^2 \mu_3^2 \sigma_1^2.$$

The interpretation of this derivation is that, if the mean and the standard deviation of the estimating error can be determined for the three factors of interest, equations 1 and 2 can be used to estimate the resulting mean and the standard deviation of the estimating error of their products. This procedure assumes that the variables of quantity, program allocation factor, and classroom allocation factor are statistically independent. This assumption seems reasonable for the classroom allocation factor. This factor is more a function of the total number of classrooms, and it is directly affected by individual differences in instructional philosophy.

However, this may not be true for quantity and the program allocation factor. It is conceivable that a relationship exists where a large quantity of a particular item increases the likelihood of its being used for reading. This seemed particularly true for tape recorders. To test this hypothesis,

the correlation coefficient was calculated between the quantity of tape recorders in a school and the probability that they are used in reading. The low value of 0.07 for this coefficient indicates that these two variables are essentially independent. Thus, the assumption about the independence of the variables seems reasonable.

The means of the observed distribution for each of the eight resources were relatively easy to determine through an examination of the data collected. These means are presented in Table 6.

The standard deviation of the estimating error is not as easily calculated, however. The shape of the observed distribution is indicative of only the frequency with which the variables occurred in the sample. There is no reason to believe that the estimating error would behave in a similar manner. Even if it did, the standard deviation of the estimating error would certainly be much less than the standard deviation of the observed distribution. Ideally, the estimating errors should have been determined from a special survey of the respondents after they completed the first questionnaire. This was not done. However, it is possible to make reasonable estimates of the value of the standard deviations based on judgment and the manner in which the questions were worded.

Where respondents were asked questions regarding the value of particular variables (e.g., the number of tape recorders), it is reasonable to assume that the error associated with the response is normally distributed. Further, it is also reasonable to assume that the majority of the responses will be within 10 percent of the correct response. For example, if a respondent indicated that he had 10 tape recorders, the actual number of tape recorders should not be greater than 11 nor less than 9 in the majority of the situations. Assuming that these points represent two standard deviations from the mean, which correspond to 95 percent of the possible situations, the standard deviation and variance can be calculated by the following equation:

$$2\,\sigma_i = 0.1\,\mu_i,$$

or

$$\sigma_i = 0.05\,\mu_i$$

and

$$\sigma_i^2 = 0.0025\,\mu_i^2. \qquad \text{Eq. 3}$$

Table 6

OBSERVED MEANS FOR FACTORS

Resource	Quantity	Program Factor	Classroom Factor
Class Instructors	17.560	.144	1.000
Teacher Aides	3.222	.680	.041
Reading Specialists	1.211	.896	.062
Other Special Teachers	.897	.174	.045
Nonteaching Academic Staff	.347	.100	.041
Tape Recorders/Record Players	10.708	.684	.046
Television/Video Tape Players	5.866	.344	.045
Basal Readers	735.913	1.000	.046

As an example, consider the tape recorder. From Table 6, the mean number of tape recorders in a school is 10.7. Thus, the standard deviation can be estimated to be 0.05 μ, or 0.803. In a similar manner, the variance is 0.645. As stated above, this is felt to be a reasonable procedure for estimating the standard deviation of the error term where a particular value is requested. Thus, it generally applies to all resource quantities and to the estimate of the program allocation factors for staff.

Where respondents were asked to indicate a range of values in response to a question, rather than the actual value (e.g., Are tape recorders used between 37.5 percent and 62.5 percent of time in reading as opposed to use for other subjects?), it is reasonable to assume that any value within the range is equally likely to occur. The standard deviation of the error term of a uniform distribution can be calculated as a function of range (i.e., highest value minus lowest value) of the interval. The derivation of this function is shown in the following paragraph.

Assume that the possible responses range from a value of $C - T/2$ to $C + T/2$, where C is the center of the range and T is the range ($[C + T/2] - [C - T/2] = T$). Since the distribution is uniform, the probability density function is

$$F(x) = \frac{1}{T}.$$

The mean is calculated as follows:

$$\mu = E(x_i) = \int_{C - T/2}^{C + T/2} x\ (1/T)\ dx = \frac{x^2}{2T}\Bigg|_{C - T/2}^{C + T/2} = C.$$

This is the expected result. The calculation of the standard deviation of the error is shown below.

$$E\ (x_i^2) = \int_{C - T/2}^{C + T/2} x^2\ (1/T)\ dx = \frac{x^3}{6T}\Bigg|_{C - T/2}^{C + T/2} = C^2 + \frac{T^2}{12}$$

$$\sigma_i^2 = E(x_i^2) - \mu^2 = \frac{T^2}{12} \qquad \text{Eq. 4}$$

Consider the tape recorder again as an example. The range of values for the program allocation factor was 0.25. Thus, the variance equals $(0.25)^2/12$, or 0.00244, and the standard deviation is 0.0494. It is felt that this procedure is reasonable for estimating the standard deviation of the error term associated with the program allocation factor for equipment.

Estimating the standard deviation of the error term for the classroom allocation factor is more difficult because it is generally a fairly complex equation. However, information is available about the entire school that allows the following logic to be used in estimating this term. The mean value of the classroom allocation (r) can be thought of as being estimated by the following equation:

$$\mu = \frac{\Sigma\ r_i}{n},$$

where n is the number of classrooms. By definition (see Volume I of this report),

$$\Sigma\ r_i = 1.$$

Thus,

$$n = \frac{1}{\mu}.$$

Using a μ of 0.047, the average values of the means of the classroom factors shown in Table 6,[1] the resulting n is approximately 21. Assume that because of some measurement errors, this value of n should have been 23. Under this condition, the μ should have been 0.043, or a difference of 0.004 (8.5 percent of original value). This seems a reasonable estimate of the maximum error in the majority of the situations. It also should be normally distributed about the mean. As was done in the derivation of equation 3, it will be assumed that this error represents two standard deviations. Thus,

$$2\,\sigma_i = 0.004,$$

or

$$\sigma_i = 0.002,$$

and

$$\sigma_i^2 = 0.000004. \qquad \text{Eq. 5}$$

This equation will generally be used to estimate the standard deviation of the error term associated with the calculation of the classroom allocation factor.

While the general procedures have been outlined above, there are two exceptions to these procedures. First, the classroom allocation factor for the class instructor was defined to be 1, thus having no variance. Similarly, the program allocation factor for basal readers was defined to be 1, again with zero variance. Table 7 presents the standard deviations of the measurement errors for each factor and each resource.

Now that both the means and the standard deviations of the error have been estimated, it is possible to estimate the composite mean and its associated standard deviation of the error using equation 1. The results of this calculation are presented in Table 8. In addition to the mean and standard deviation, this table also presents the standard error of estimate expressed as a percentage of the mean. This is the usual method for

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1. As will be discussed in subsequent paragraphs, the classroom allocation factor for the class instructor was defined to be 1, and thus had no variance. For this reason, it was not used when calculating the average of 0.0466.

Table 7

OBSERVED STANDARD DEVIATION OF ERRORS FOR FACTORS

Resource	Quantity		Program Factor		Classroom Factor	
	Standard Deviation	Equation Used	Standard Deviation	Equation Used	Standard Deviation	Equation Used
Class Instructors	.878	(3)	.010	(4)	0	a
Teacher Aides	.161	(3)	.034	(3)	.002	(5)
Reading Specialists	.067	(3)	.042	(3)	.002	(5)
Other Special Teachers	.045	(3)	.009	(3)	.002	(5)
Nonteaching Academic Staff	.017	(3)	.002	(3)	.002	(5)
Tape Recorders/Record Players	.535	(3)	.072	(4)	.002	(5)
Television/Video Tape Players	.293	(3)	.072	(4)	.002	(5)
Basal Readers	36.796	(3)	0	a	.002	(5)

a. Factor defined to equal 1; therefore, there is no variance.

Table 8

RESULTS OF MEASUREMENT ERROR ANALYSIS

Resource	Composite Mean	Composite Standard Deviation	Standard Error of Estimate[a]	Maximum Error[b] as a Percent of Mean
Class Instructors	2.529	.216	8.5	17.1
Teacher Aides	.090	.007	8.3	16.5
Reading Specialists	.067	.005	7.4	14.7
Other Special Teachers	.007	.001	8.3	16.6
Nonteaching Academic Staff	.001	.0001	8.0	16.0
Tape Recorders/Record Players	.337	.042	12.5	24.9
Television/Video Tape Players	.091	.020	22.0	44.0
Basal Readers	33.852	2.231	6.6	13.2

a. Also called the coefficient of variation. Expressed as a percent of the mean. Approximately 68 percent of the observations will be in this range.

b. Twice the standard error. Expressed as a percent of the mean. Approximately 95 percent of the observations will be in this range.

expressing the error associated with an estimate. The true value should be within an interval of one standard error on either side of the observed value 68 percent of the time. As an example, if the costing model estimates that a particular classroom uses 0.250 tape recorders in its reading program (equivalent to sharing one recorder with four other classrooms), Table 8 can be used to determine that the actual quantity of tape recorder use should be in the interval 0.250 ± 0.033 ($0.250 \times 0.125 = 0.033$) 68 percent of the time. Because 32 percent of the time the true value will be outside of this interval, Table 8 also presents the maximum possible error in the majority of the situations (95 percent).

It can be seen that the measurement errors do affect the confidence that can be placed in the cost estimates. Except for the estimates associated with the estimates of equipment, the standard errors are between 5 and 10 percent, with the maximum errors in the 15 to 20 percent range. The errors associated with the equipment estimates are quite high. This is the direct result of the manner in which data were collected concerning the amount of time a piece of equipment was used in reading.

Generally, the maximum error is between 15 and 20 percent for any resource. It should be remembered, however, that the errors associated with any particular estimate are random, and thus have both positive and negative values. Thus, when the costs are aggregated into larger resource categories, the maximum errors tend to reduce because the individual errors cancel each other out. Mathematically, it can be shown that, when a series of independent random variables is added, the variance of the sum is equal to the sum of the variances of the individual variables, or

$$\sigma_R^2 = \Sigma \sigma_i^2 . \qquad \text{Eq. 6}$$

Using this equation, it is possible to estimate the error associated with the various subtotals and total costs. In particular, we will examine the error associated with the estimate of total staff cost and with the grand total cost of the reading program. Table 4-4 of Volume I of this report is used as the basis for this examination. The means for the various resources are presented in Table 9 below. The means presented in Table 8 are for the

product npr, while the means in Table 9 are computed for this product times the unit cost and divided by the number of students in the class. We have already stated that there is no measurement error in the unit costs because they are defined to be the same for all schools. For the purposes of illustration, we will also assume that there is no error associated with the number of students in the class. Therefore, the coefficient of variation determined from Table 8 directly applies to the means presented in Table 9, allowing the calculation of their error standard deviations. The normalized standard deviation for facilities and for district centers was assumed equal to that for the class instructor. The average of the normalized standard deviation for psychologists and principals was used for the other staff category, while the average of tape recorders and televisions was used for all equipment. The values for basal readers was used for materials. The results of this examination are also presented in Table 9, and include the normalized standard deviation, the actual standard deviation, the variance, and the maximum error expressed as a percentage of the mean.

It can be seen that, while some of the individual standard errors range up to 17 percent, the error associated with total staff cost is only 11 percent. Likewise, the error associated with the grand total cost is approximately 8.8 percent. Both these values are significantly less than the individual errors and give additional credibility to the cost model.

SUMMARY

Several conclusions can be drawn from the analysis of error associated with the data collected. First, the problem of missing data does not seem to be serious. The response rate was generally in excess of 90 percent. The use of average values for missing data should not significantly affect the results, while allowing most of the classrooms to be retained in the data base.

Second, and more important, the errors associated with the estimation of the cost of particular resources should generally not exceed 15 to 20 percent of the indicated value. This figure is generally acceptable in cost estimations. The only major exception to this statement is the cost estimates associated with equipment, which could be off by as much as one-third or more. This is particularly true for pieces of equipment with limited use in the reading program such as televisions. However, the impact of this inaccuracy on the total cost is not important because of the low cost

of equipment. The error associated with the cost of groups of resources (e.g., all staff) should usually be around 10 percent.

Table 9

IMPACT OF ERROR ON TOTAL COSTS

Resource	Mean	Coefficient of Variation	Standard Deviation	Variance	Standard Error of Estimate[a]	Maximum Error[b] as a Percent of Mean
Class Instructors	107.01	.085	9.096	82.732	8.5	17.1
Teacher Aides	12.20	.083	1.013	1.026	8.3	16.6
Reading Specialists	20.99	.0736	1.544	2.385	7.4	14.7
Other Staff	24.80	.0815	2.020	4.080	8.2	16.3
All Staff	165.00	.0576	9.499	90.034	5.5	11.0
Facilities	50.86	.085	4.323	18.688	8.5	17.1
Equipment	4.16	.1725	.718	.515	17.3	34.6
Materials	14.06	.0659	.927	.859	6.6	13.2
District Centers	4.71	.085	.400	.097	8.5	17.1
Total Costs	238.79	.0440	10.506	110.382	4.4	8.8

a. Expressed as a percent of the mean. Approximately 68 percent of the observations will be in this range.

b. Expressed as a percent of the mean. Approximately 95 percent of the observations will be in this range.

4

REDESIGN OF THE DATA COLLECTION INSTRUMENTS

Many of the problems encountered in the design and implementation of the cost-estimating model were caused by weaknesses in the manner in which the data were collected. In an effort to better prepare for future research in estimating the costs of reading programs, it is desirable to redesign the data collection instruments where necessary to reflect the lessons learned during the data collection activities of this study.

The recommendations that are discussed first pertain to the Program and Class Characteristics Questionnaire designed by ETS. This discussion is generally self-explanatory and does not require a copy of the questionnaire. The latter part of this chapter is related to the Resource Questionnaire designed by RMC. While most of the discussion is self-explanatory, certain situations require an examination of this questionnaire, a copy of which can be found in Appendix A of Volume I of this report.

RECOMMENDED CHANGES: PROGRAM AND CLASS CHARACTERISTICS QUESTIONNAIRE

By using the question-numbering sequence found in the Program and Class Characteristics Questionnaire, only Questions 19, 21, 29, and 32 (Compensatory Programs) solicit information used for the purposes of cost analysis. Therefore, only these questions will be discussed in this section. Each question will be presented as it appeared in the original data collection instrument and will be followed by recommended changes.

Question #19

What is the average amount of formal instructional time per student in reading?

a. Minutes per instructional period:

1 ☐	1-15	5 ☐	51-60
2 ☐	16-30	6 ☐	61-75
3 ☐	31-40	7 ☐	76-90
4 ☐	41-50	8 ☐	91 or more

b. Number of instruction periods per week:

1 ☐	One	3 ☐	Four or five
2 ☐	Two or three	4 ☐	More than five

The data gathered by this question is used to estimate the number of pupil hours of instruction in reading during the school year. At best, the data can provide only a very rough estimate. Highly accurate estimates are obtainable at great cost. If funds are available, a respondent should be asked a question similar to the one above at least three or four times during the school year. Each question should relate to only one basic response so the respondent doesn't have to make calculations other than addition and subtraction. A better approach would be to ask each respondent the number of pupils she provides reading instruction to and then simply ask for the number of minutes of reading instruction provided during the last week. The more times this question is asked of the same respondent during the school year, the better the estimate of pupil hours of instruction will be. This approach also provides teacher hours of instruction.

Question #21

What additional personnel are available to you in your teaching of reading?

	Often	Some-Times	Rarely	Not Available
Remedial reading teacher or supervisor	☐	☐	☐	☐
Other professionals (counselors, psychologists, etc.)	☐	☐	☐	☐
Paraprofessionals or teacher aides	☐	☐	☐	☐
Parent or other volunteer	☐	☐	☐	☐
Student teacher	☐	☐	☐	☐
Media specialist	☐	☐	☐	☐
Resource teacher (music, art, etc.)	☐	☐	☐	☐
Older student in school	☐	☐	☐	☐
Other (Specify) _____	☐	☐	☐	

_____

RMC used the responses to this question to estimate the utilization of individuals whose time is shared by many classes. The question worked fairly well, but translating the words "often," "sometimes," and "rarely" into hours was no more than an educated guess. The data would be more useful if the question was reworded and the response headers were made specific, such as:

During the last month, how many hours were each of the following personnel types used to assist you in your teaching of reading?

Greater than 15 hours	5 to 15 hours	1 to 4 hours	Less than 1 hour	Not Available

This format would provide a less ambiguous utilization distribution. The estimates could also be made more accurate if the question was asked two or more times over the course of the school year.

Question #29

To what extent do you use each of the following approaches to teaching reading in your classroom?

	Not at All	Minimally	Somewhat	Extensively
Basal readers	☐	☐	☐	☐
Programmed instruction	☐	☐	☐	☐
A total phonics program	☐	☐	☐	☐
A supplementary phonics program	☐	☐	☐	☐
Language experience	☐	☐	☐	☐
A linguistic program	☐	☐	☐	☐
Non-standard orthography (example: i.t.a.)	☐	☐	☐	☐
Words in color	☐	☐	☐	☐
Individualized programs	☐	☐	☐	☐
Technological devices such as "talking typewriter" or teaching machines	☐	☐	☐	☐
Other (Specify and describe)		☐	☐	☐

_____

_____

_____

_____

The responses to this question were used to allocate the cost of materials and "technological devices" across classrooms. The question was inadequate for this purpose. In RMC's opinion, a series of questions is required to provide reasonable estimates of the utilization of materials and equipment. Question 32 served as the equipment utilization counterpart to the question above.

Question #32

How frequently do you use the following materials in the course of your reading instruction?

	Not Available	Often	Some-Times	Rarely or Never Use
Textbooks other than basal readers	☐	☐	☐	☐
Books and printed materials other than textbooks	☐	☐	☐	☐
Newspapers, magazines, and other periodicals	☐	☐	☐	☐
Teacher-prepared materials (dittos, etc.)	☐	☐	☐	☐
Motion pictures and/or filmstrips	☐	☐	☐	☐
Slides and transparencies	☐	☐	☐	☐
Tape recordings and records	☐	☐	☐	☐
Video or television tapes	☐	☐	☐	☐
Games, puzzles, and toys	☐	☐	☐	☐
Other (Specify)		☐	☐	☐

_____

_____

_____

It is suggested that Questions 29 and 32 be replaced by the following series of questions.

Q. During the last month, approximately how many of your reading instruction class periods involved the use of the following types of instructional materials and equipment?

	No Periods	1-3 Periods	4-10 Periods	10-15 Periods	More than 15 Periods
Basal Readers (Primary)					
Supplementary Books					
Reading Instructional Systems (Publishers' Systems)					
Sets or Kits for Supplementary Reading Instruction					
Audio-Visual Equipment					

Q. How many basal readers (primary) do you use for reading instruction?

_____

Q. How many supplementary books do you use for reading instruction?

_____

Q. For each type of reading instruction system (publishers' system) you use, please identify below the name and publisher, plus the number of students for which you have purchased instructional materials. If you use no system, mark NA.

System	Publisher	Students Served

Q. For each set or kit used for supplementary reading instruction, please list its name and publisher, the number of units of this type you use, and check the far right column if the set or kit is shared with other teachers. If you use no sets or kits, please mark NA.

Set or Kit	Publisher	Units	Check this box if set is shared with other teachers
			☐
			☐
			☐
			☐
			☐

Q. For each equipment type listed below, please check those you have used during the last three months.

1	Cassette Recorder	☐
2	Reel-to-Reel Recorder	☐
3	Phonograph	☐
4	Film Strip Projector	☐
5	Slide Projector (Carousel)	☐
6	Opaque Projector	☐
7	Overhead Projector	☐
8	16 mm Projector (sound)	☐
9	Television	☐
10	Filmstrip/Phonograph Projector	☐
11	Cassette Film Strip Projector	☐
12	Individual Filmstrip Viewer	☐
13	Listening Center and Headphones	☐

The series of questions shown above will enable the analyst to estimate usage of materials and equipment with reasonable accuracy, both within and across classes for all major items found in the classroom. In addition to these questions, each teacher should be asked to write a short narrative describing his or her philosophy of teaching reading, his basic classroom structure, and his schedule if he teaches more than one reading class. This would be helpful in identifying data problems if any exist.

RECOMMENDED CHANGES: RESOURCE QUESTIONNAIRE

The original design of the Resource Questionnaire contained many questions that were included on a trial basis to test their feasibility for gathering cost and utilization data. Some of these questions did not produce the desired results, while, on the other hand, many worked relatively well. This section contains three areas: one on generalized changes, one designating questions that RMC recommends being omitted from future surveys, and one containing changes to questions that RMC feels can be improved upon.

General Changes

The original Resource Questionnaire was designed to identify the cost of both compensatory and developmental reading. As the study progressed, it became apparent that this would be very difficult and somewhat arbitrary because of definitional problems. For this reason, these two areas of reading were not studied, and RMC recommends that only reading in general be studied using the revised data collection instruments. Therefore, all references to compensatory and developmental reading should be omitted or replaced by the word reading only. This includes the definitions listed in the glossary of terms.

The glossary of terms is very necessary to ensure that respondents answer all questions in the same framework using standardized definitions. However, the glossary in the Resource Questionnaire was not well used by the respondents. This was obvious after reading some of the responses and visiting several of the schools participating in the study. This problem can best be solved by dispersing the definitions throughout the questionnaire. Each definition should be placed immediately preceding the question or instruction it pertains to. If the defined word is used in more than one place, the definition should be repeated as many times as necessary. By using this format, the respondent doesn't have to remember defined words or hunt for definitions.

Recommended Omissions

At the outset of the original study, a few questions were included even though it was known that some would probably not be used if standardized cost estimates could be derived or more accurate data could be obtained from

other sources. For these reasons, it is recommended that the following questions be omitted from the Resource Questionnaire in future studies.

3	15b
4	15c
5	19
6	19a
9	20
9a	21
10	21a
15	22
15a	22a

Recommended Changes to Questions

Question 7e

Indicate in Columns V, VI, VII, and VIII the rough split of a staff type's time spent in activities relating to developmental reading, compensatory reading, reading support activities, and other subject activities. The sum of each of these four columns should be 100 percent for each staff type.

	V	VI	VII	VIII
	Developmental Reading (% Time)	Compensatory Reading (% Time)	Reading Support Activities (% Time)	Other Subject Activities (% Time)
Staff Type				

Question 7e attempted to gather data on the amount of time each school staff member spent in various areas of instruction. The primary interest focused on developmental and compensatory reading. Since we omitted this breakout from our original study, we recommend that question 7e be changed to the following:

Q. Indicate in column V the approximate percentage of total time each staff type spends on the instruction of reading:

V
Percent of Total Time Spent on Reading Instruction

Questions 8, 8a, 8b

8. If in Q. 7 you listed either paid or volunteer teacher aides, do they assist in the developmental and/or compensatory reading programs in your school in the second, fourth, and sixth grades?

Yes ..... ☐
No (GO TO Q. 11) ..... ☐

8a. (IF YES) Please indicate in Column A in the table below how many paid teacher aides (expressed as full-time equivalents) are used in your school at each grade level listed? (IF NONE, WRITE "NONE.")

*8b. Please indicate in Columns B, C, D, and E the approximate percent of time that paid teacher aides at each grade level spend with developmental reading, compensatory reading, reading support activities, and other subject activities. The sum of these four columns should be 100 percent for each row.

Grade	A	B	C	D	E
	Teacher-Aides (Full-Time Equivalents)	Developmental Reading (% Time)	Compensatory Reading (% Time)	Reading Support Activities (% Time)	Other Subject Activities (% Time)
2	9-12	13-15	16-18	19-21	22-24
4	25-28	29-31	32-34	35-37	38-40
6	41-44	45-47	48-50	51-53	54-56

Questions 8, 8a, and 8b were designed to quantify the utilization of teacher aides in the instruction of reading. The series of questions failed to provide usable results in cases where teacher aides were shared across grades. For this reason, RMC recommends changing the series of questions to the following:

8. If in Q. 7 you listed either paid or volunteer teacher aides, do they assist in reading programs in your school in the second, fourth, or sixth grades?

Yes.....[ ]
No (GO TO Q. 11)[ ]

8a. If yes, please list the number of full-time equivalent teacher aides employed in your school. _____

8b. Please indicate below the total number of hours all teacher aides spent assisting the instruction of reading for grades 2, 4, and 6 during the last week.

Grade	Total Hours All Teacher Aides Spent Assisting Your Reading Programs During the Last Week
2	
4	
6	

Questions 11 and 12

All parts of questions 11 and 12 worked reasonably well in the original study. The data these types of questions solicit are difficult to obtain via a mailout questionnaire. In most cases, the respondent having reading or resource centers will have to be recontacted by telephone to ensure complete data. This is really the only feasible way to gather accurate data in areas where the nature of responses varies a great deal and is often vague in meaning.

Questions 23 and 23a

For each type of equipment listed, indicate the number that are available in your school. Please include all equipment items regardless of their use. (IF NONE, WRITE "NONE.")

How often is each type of equipment used in reading instruction, either compensatory or developmental, as opposed to use for other subject areas in your school? (CHECK THE MOST APPROPRIATE DESCRIPTION OF ITS USE.)

	Q. 23.	Q. 23a.				
	Number that are available	Almost Always Used in Reading	Generally Used in Reading	Used About Half the Time in Subject Areas Other Than Reading	Generally Used in Subject Areas Other Than Reading	Almost Always Used in Subject Areas Other Than Reading
Tape Recorder	____	☐	☐	☐	☐	☐
Record Player	____	☐	☐	☐	☐	☐
Movie Projector	____	☐	☐	☐	☐	☐
Filmstrip Projector	____	☐	☐	☐	☐	☐
Slide Projector	____	☐	☐	☐	☐	☐
Opaque Projector	____	☐	☐	☐	☐	☐
Overhead Projector	____	☐	☐	☐	☐	☐
Television	____	☐	☐	☐	☐	☐
Language Master	____	☐	☐	☐	☐	☐
Tachistoscope	____	☐	☐	☐	☐	☐
Controlled Reader	____	☐	☐	☐	☐	☐
Shadowscope Reading Pacer	____	☐	☐	☐	☐	☐
Other Major Equipment (SPECIFY):						
_____	____	☐	☐	☐	☐	☐
_____	____	☐	☐	☐	☐	☐
_____	____	☐	☐	☐	☐	☐

These two questions worked very well. However, in RMC's opinion, the list of equipment items should be changed to the following:

1 Cassette Recorder
2 Reel-to-Reel Recorder
3 Phonograph
4 Film Strip Projector
5 Slide Projector (Carousel)
6 Opaque Projector
7 Overhead Projector
8 16 mm Projector (sound)
9 Television
10 Film Strip/Phonograph Projector
11 Cassette/Film Strip Projector
12 Individual Filmstrip Viewer
13 Listening Center and Headphones

Question 24

*24. What is the approximate inventory of basal readers used in your school for reading instruction, either developmental or compensatory? How many are used exclusively for compensatory reading? (CHECK ONE IN EACH COLUMN.)

	Total Basal Readers Used for All Reading	Basal Readers Used Exclusively for Compensatory Reading
None	☐ -01	☐ -01
1 - 9	☐ -02	☐ -02
10 - 24	☐ -03	☐ -03
25 - 49	☐ -04	☐ -04
50 - 99	☐ -05	☐ -05
100 - 199	☐ -06	☐ -06
200 - 399	☐ -07	☐ -07
400 - 799	☐ -08	☐ -08
800 - 1,599	☐ -09	☐ -09
1,600 - 3,199	☐ -10	☐ -10
3,200 or over	☐ -11	☐ -11

This question worked well. However, in future studies, emphasis should be placed on primary versus supplementary readers. In fact, these two terms should be defined accurately. RMC recommends that the question then be changed to the following:

Q. What is the approximate inventory of basal readers used in your school for reading instruction. (CHECK ONE IN EACH COLUMN. PLEASE ANSWER FOR BOTH PRIMARY AND SUPPLEMENTARY READERS.)

	Total Primary Basal Readers Used For All Reading	Total Supplementary Basal Readers Used For All Reading
None	☐ -01	☐ -01
1 - 9	☐ -02	☐ -02
10 - 24	☐ -03	☐ -03
25 - 49	☐ -04	☐ -04
50 - 99	☐ -05	☐ -05
100 - 199	☐ -06	☐ -06
200 - 399	☐ -07	☐ -07
400 - 799	☐ -08	☐ -08
800 - 1,599	☐ -09	☐ -09
1,600 - 3,199	☐ -10	☐ -10
3,200 or over	☐ -11	☐ -11

Questions 26 and 26a

Does your school have any commercially available reading sets (e.g., Alpha One, Sullivan, Distar, etc.)?

Yes ..... ☐
No (END OF QUESTIONNAIRE). ☐

(IF YES) Please indicate the name, publisher, and number of students for which the set was purchased.

	Set Name	Publisher	Number of Students
1.			
2.			
3.			
4.			
5.			

These two questions worked very well and the only change involves the clarification of what is being asked for. The first question should be changed to the following, in RMC's opinion:

Q. Does your school have any published individual reading kits (e.g., Alpha One, Sullivan, Distar, etc.)?

CONCLUSION

RMC feels that recommended changes to the two data collection instruments will greatly simplify and improve their quality and enhance future study efforts where cost and utilization data concerning reading programs are required. In most future studies, additional questions will probably be added for many reasons. Therefore, obvious changes to question numbers and keypunch instructions have been omitted from this discussion.

APPENDIX

DETAILED RESULTS OF THE SENSITIVITY ANALYSES

EXAMINATION 1

CLASSES WITH 10 OR LESS STUDENTS ARE CHARGED WITH ONE HALF THE FACILITIES COST OF OTHER CLASSES

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	165.00	0.0	0.0	1.000
FACILITIES SUBTOTAL	40.48	-9.66	13.26	0.878
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	228.41	-2.32	4.158	0.991
LOW	67.16	-19.41		
1ST QUARTILE	131.31	-2.82		
2ND QUARTILE	178.36	0.0		
3RD QUARTILE	264.70	0.0		
HIGH	1160.91	0.0		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	110.81	0.0	0.0	1.000
FACILITIES SUBTOTAL	31.06	-2.25	8.339	0.880
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	163.63	-0.39	1.470	0.996
LOW	53.68	-11.49		
1ST QUARTILE	114.94	0.0		
2ND QUARTILE	143.69	0.0		
3RD QUARTILE	185.40	0.0		
HIGH	615.75	0.0		

EXAMINATION 2a

A TEACHER IS AVAILABLE 35 HOURS PER WEEK

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	91.72	-14.29	0.033	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	23.58	-7.66	4.450	0.999
STAFF SUBTOTAL	148.49	-10.04	3.140	0.995
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	222.28	-6.71	1.832	0.999
LOW	67.60	-9.75		
1ST QUARTILE	124.44	-8.24		
2ND QUARTILE	168.77	-6.90		
3RD QUARTILE	248.55	-5.42		
HIGH	1276.15	-1.97		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	57.00	-14.29	0.030	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	21.58	-7.66	4.390	0.999
STAFF SUBTOTAL	100.16	-10.38	2.936	0.997
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	154.10	-6.71	1.565	0.999
LOW	49.63	-9.68		
1ST QUARTILE	106.48	-7.95		
2ND QUARTILE	134.72	-6.72		
3RD QUARTILE	177.32	-5.82		
HIGH	580.98	-2.17		

EXAMINATION 2b

A TEACHER IS AVAILABLE 25 HOURS PER WEEK

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	128.41	20.01	0.047	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	26.52	10.73	6.241	0.997
STAFF SUBTOTAL	188.12	14.05	4.397	0.994
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	261.91	9.40	2.565	0.998
LOW	80.16	2.76		
1ST QUARTILE	146.25	7.59		
2ND QUARTILE	201.29	9.67		
3RD QUARTILE	296.82	11.54		
HIGH	1565.28	13.65		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	79.81	20.00	0.045	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	24.34	10.73	6.159	0.999
STAFF SUBTOTAL	125.72	14.53	4.109	0.995
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	179.66	9.39	2.191	0.998
LOW	59.34	3.04		
1ST QUARTILE	126.16	8.15		
2ND QUARTILE	157.51	9.41		
3RD QUARTILE	202.32	11.14		
HIGH	664.44	13.56		

EXAMINATION 3

TEACHERS WHO IMPROPERLY ANSWERED QUESTION
REGARDING READING INSTRUCTION TIME

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	199			
CLASS INSTRUCTOR	102.39	-4.17	11.53	0.929
TEACHER AIDE	11.76	2.19	13.78	0.896
READING SPECIALIST	18.41	-6.21	10.79	0.949
OTHER STAFF	22.68	-3.28	21.43	0.509
STAFF SUBTOTAL	155.24	-3.78	16.54	0.831
FACILITIES SUBTOTAL	48.14	-4.61	11.92	0.925
EQUIPMENT SUBTOTAL	3.89	-4.66	20.43	0.753
MATERIALS SUBTOTAL	13.55	-4.17	10.52	0.979
DISTRICT CENTER SUBTOTAL	4.31	-4.04	15.71	0.810
TOTAL COST	225.13	-4.05	13.25	0.858
LOW	0.0	-100.00		
1ST QUARTILE	126.38	-0.76		
2ND QUARTILE	172.02	0.0		
3RD QUARTILE	267.98	0.0		
HIGH	1396.59	34.52		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	139			
CLASS INSTRUCTOR	62.74	-5.75	23.45	0.523
TEACHER AIDE	5.56	-5.00	49.33	0.196
READING SPECIALIST	10.23	-14.54	19.72	0.755
OTHER STAFF	20.07	-6.85	17.13	0.808
STAFF SUBTOTAL	98.60	-6.36	36.18	0.385
FACILITIES SUBTOTAL	29.89	-6.54	33.37	0.467
EQUIPMENT SUBTOTAL	2.87	-6.37	13.43	0.938
MATERIALS SUBTOTAL	13.36	-6.76	12.17	0.951
DISTRICT CENTER SUBTOTAL	4.32	-5.97	11.92	0.963
TOTAL COST	149.04	-6.36	34.51	0.409
LOW	0.0	-100.00		
1ST QUARTILE	108.33	0.0		
2ND QUARTILE	133.26	0.0		
3RD QUARTILE	179.22	0.0		
HIGH	545.74	81.36		

EXAMINATION 4a

SEVEN PERCENT OF ADMINISTRATIVE COST IS ALLOCATED TO READING PROGRAM

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS				
NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	20.56	-24.99	15.42	0.968
STAFF SUBTOTAL	160.75	-2.92	2.391	0.998
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	234.54	-1.97	1.634	0.999
LOW	69.07	-9.70		
1ST QUARTILE	130.59	-2.65		
2ND QUARTILE	180.52	-1.65		
3RD QUARTILE	263.33	-0.87		
HIGH	1391.70	0.42		
DEVELOPMENTAL READING PROGRAMS				
NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	18.76	-25.71	16.86	0.983
STAFF SUBTOTAL	106.83	-3.86	3.126	0.997
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	160.77	-2.52	2.001	0.998
LOW	53.93	-12.48		
1ST QUARTILE	112.83	-3.02		
2ND QUARTILE	141.50	-2.20		
3RD QUARTILE	180.84	-1.25		
HIGH	612.85	0.47		

EXAMINATION 4b

ADMINISTRATIVE COST IS ELIMINATED FROM READING PROGRAM

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS				
NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	16.22	-53.58	15.65	0.915
STAFF SUBTOTAL	156.42	-6.20	4.069	0.995
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	230.21	-4.18	2.634	0.997
LOW	64.03	-13.85		
1ST QUARTILE	126.65	-5.41		
2ND QUARTILE	175.40	-3.82		
3RD QUARTILE	258.45	-2.24		
HIGH	1386.52	0.0		
DEVELOPMENTAL READING PROGRAMS				
NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	14.69	-53.62	11.48	0.967
STAFF SUBTOTAL	102.77	-8.03	4.895	0.992
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	156.71	-5.21	2.957	0.996
LOW	49.51	-15.93		
1ST QUARTILE	109.45	-6.52		
2ND QUARTILE	138.91	-4.76		
3RD QUARTILE	174.72	-3.50		
HIGH	610.37	0.0		

EXAMINATION 5

TEACHERS OF SUPPLEMENTAL READING CLASSES CALLED READING SPECIALISTS RATHER THAN INSTRUCTORS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	52.91	-22.84	61.72	0.051
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	75.08	373.98	473.14	0.044
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	165.00	0.0	0.0	1.000
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	238.79	0.0	0.0	1.000
LOW	72.83	0.0		
1ST QUARTILE	133.49	0.0		
2ND QUARTILE	182.57	0.0		
3RD QUARTILE	267.96	0.0		
HIGH	1396.59	0.0		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	64.57	-1.15	9.881	0.647
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	15.98	0.0	0.0	0.657
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	110.81	0.0	0.0	1.000
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	164.75	0.0	0.0	1.000
LOW	53.68	0.0		
1ST QUARTILE	115.15	0.0		
2ND QUARTILE	143.74	0.0		
3RD QUARTILE	187.45	0.0		
HIGH	615.75	0.0		

EXAMINATION 6

READING SPECIALISTS COMPLETING QUESTIONNAIRES ALLOCATED INDEPENDENT OF NUMBER OF STUDENTS TO CLASSES

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.93	0.50	6.241	0.987
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	165.92	0.33	4.004	0.990
FACILITIES SUBTOTAL	51.23	0.38	5.079	0.991
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	240.09	0.31	3.905	0.991
LOW	72.83	-5.64		
1ST QUARTILE	133.70	0.0		
2ND QUARTILE	182.57	0.0		
3RD QUARTILE	267.96	0.0		
HIGH	1396.59	53.18		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.34	-0.30	3.502	0.997
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	110.65	-0.09	1.068	0.999
FACILITIES SUBTOTAL	32.09	-0.30	3.533	0.996
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	164.50	-0.11	1.309	0.999
LOW	53.68	-15.49		
1ST QUARTILE	115.15	0.0		
2ND QUARTILE	143.74	0.0		
3RD QUARTILE	187.45	0.0		
HIGH	615.75	0.0		

EXAMINATION 7

READING SPECIALIST NOT COMPLETING QUESTIONNAIRES
ALLOCATED ONLY TO COMPENSATORY CLASSES

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	62.42	294.39	49.43	0.450
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	206.43	33.50	32.17	0.695
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	280.22	23.93	16.74	0.823
LOW	78.12	-3.55		
1ST QUARTILE	157.03	0.0		
2ND QUARTILE	226.18	0.0		
3RD QUARTILE	332.70	30.09		
HIGH	1396.59	324.15		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	1.83	-88.16	83.45	0.124
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	98.59	-8.73	21.43	0.817
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	152.53	-6.40	13.49	0.897
LOW	53.68	-65.02		
1ST QUARTILE	108.76	-10.83		
2ND QUARTILE	133.12	0.0		
3RD QUARTILE	166.53	0.0		
HIGH	615.75	0.0		

EXAMINATION 8a

PRINCIPALS ALLOCATED TO CLASSES INDEPENDENT OF NUMBER OF STUDENTS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS				
NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	25.84	6.50	11.46	0.969
STAFF SUBTOTAL	166.04	0.13	2.143	0.998
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	239.83	0.06	1.468	0.999
LOW	72.70	-2.90		
1ST QUARTILE	132.81	-0.64		
2ND QUARTILE	183.49	-0.09		
3RD QUARTILE	270.24	0.47		
HIGH	1413.86	8.07		
DEVELOPMENTAL READING PROGRAMS				
NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	21.35	-8.21	10.35	0.995
STAFF SUBTOTAL	109.43	-1.32	1.726	0.999
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUHTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	163.37	-0.88	1.083	0.999
LOW	52.36	-5.64		
1ST QUARTILE	114.03	-1.34		
2ND QUARTILE	143.09	-0.68		
3RD QUARTILE	185.88	-0.23		
HIGH	615.44	1.64		

EXAMINATION 8b

LIBRARY ALLOCATED TO CLASSES INDEPENDENT OF NUMBER OF STUDENTS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	165.00	0.0	0.0	1.000
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	16.21	12.19	21.62	0.749
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	240.95	0.26	3.037	0.997
LOW	72.60	-4.31		
1ST QUARTILE	132.72	-0.97		
2ND QUARTILE	183.52	-0.15		
3RD QUARTILE	272.94	0.67		
HIGH	1404.42	29.45		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	110.81	0.0	0.0	1.000
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	12.21	-14.47	16.74	0.964
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	162.77	-1.34	1.989	0.999
LOW	51.21	-13.87		
1ST QUARTILE	113.14	-1.91		
2ND QUARTILE	142.85	-0.95		
3RD QUARTILE	184.50	-0.26		
HIGH	615.50	2.56		

EXAMINATION 9a

RESOURCES SHARED ON 20:10:1:0 BASIS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	[illegible]
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.24	2.32	11.32	0.990
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.46	-0.01	1.145	1.000
STAFF SUBTOTAL	165.10	0.07	2.297	1.000
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.16	-0.45	5.123	0.998
MATERIALS SUBTOTAL	14.04	-0.15	0.740	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	238.88	0.06	1.703	1.000
LOW	72.83	-11.70		
1ST QUARTILE	134.33	-0.02		
2ND QUARTILE	185.21	0.0		
3RD QUARTILE	267.97	0.05		
HIGH	1394.86	13.41		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.06	-9.10	15.63	0.961
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.01	0.749	1.000
STAFF SUBTOTAL	110.35	-0.45	3.212	0.997
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	3.02	-1.45	9.020	0.988
MATERIALS SUBTOTAL	14.21	0.16	0.596	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	164.34	-0.29	2.424	0.998
LOW	53.70	-20.19		
1ST QUARTILE	115.08	-0.06		
2ND QUARTILE	142.63	0.0		
3RD QUARTILE	187.51	0.04		
HIGH	619.66	4.12		

EXAMINATION 9b

RESOURCES SHARED ON 20:5:1:0 BASIS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS				
NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.40	1.53	8.491	0.998
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.84	-0.04	1.889	1.000
STAFF SUBTOTAL	165.24	0.12	0.899	1.000
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.22	0.38	12.72	0.978
MATERIALS SUBTOTAL	14.00	-0.41	3.043	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	239.04	0.09	0.787	1.000
LOW	73.18	-4.44		
1ST QUARTILE	133.24	-0.04		
2ND QUARTILE	182.30	0.0		
3RD QUARTILE	268.71	0.22		
HIGH	1399.24	6.63		
DEVELOPMENTAL READING PROGRAMS				
NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	86.50	0.0	0.0	1.000
TEACHER AIDE	7.93	-6.60	12.63	0.973
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.58	-0.28	2.796	0.999
STAFF SUBTOTAL	111.07	-0.21	2.722	0.989
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.88	-4.32	16.43	0.994
MATERIALS SUBTOTAL	14.21	0.09	3.282	0.999
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	164.92	-0.17	1.955	0.994
LOW	53.65	-15.13		
1ST QUARTILE	115.56	-0.23		
2ND QUARTILE	143.59	-0.05		
3RD QUARTILE	188.45	0.05		
HIGH	698.12	13.38		

EXAMINATION 10

READING SPECIALISTS USE RESOURCES FOUR TIMES MORE OFTEN THAN REGULAR TEACHERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	11.61	-0.39	7.461	0.991
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.69	-0.06	1.847	0.997
STAFF SUBTOTAL	164.29	-0.13	1.306	0.999
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.00	-0.88	8.283	0.974
MATERIALS SUBTOTAL	13.98	-0.22	2.269	0.999
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	237.85	-0.12	1.156	0.999
LOW	72.85	-10.55		
1ST QUARTILE	133.95	-0.20		
2ND QUARTILE	182.72	0.02		
3RD QUARTILE	266.70	0.26		
HIGH	1388.97	1.86		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.41	2.35	6.380	0.992
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.78	0.18	1.880	0.999
STAFF SUBTOTAL	110.74	0.11	1.032	0.998
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	3.07	3.03	5.999	0.995
MATERIALS SUBTOTAL	14.21	0.43	1.996	0.999
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	164.79	0.17	0.945	0.998
LOW	53.71	-6.49		
1ST QUARTILE	115.50	0.0		
2ND QUARTILE	143.78	0.16		
3RD QUARTILE	187.99	0.35		
HIGH	542.90	3.11		

EXAMINATION 11a

ALL STAFF SALARIES INCREASED BY 10%

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	117.71	10.00	0.027	1.000
TEACHER AIDE	13.42	10.02	0.367	1.000
READING SPECIALIST	23.09	9.99	0.068	1.000
OTHER STAFF	27.28	10.02	0.072	1.000
STAFF SUBTOTAL	181.51	10.00	0.027	1.000
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	255.29	6.85	0.735	1.000
LOW	76.88	3.63		
1ST QUARTILE	143.18	6.46		
2ND QUARTILE	195.22	6.82		
3RD QUARTILE	284.95	7.31		
HIGH	1483.74	9.00		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	73.16	10.00	0.027	1.000
TEACHER AIDE	8.27	10.02	0.280	1.000
READING SPECIALIST	15.45	10.00	0.038	1.000
OTHER STAFF	25.00	10.01	0.061	1.000
STAFF SUBTOTAL	121.89	10.00	0.028	1.000
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	175.83	6.64	0.837	0.999
LOW	57.18	4.06		
1ST QUARTILE	122.09	6.17		
2ND QUARTILE	153.65	6.71		
3RD QUARTILE	200.38	7.15		
HIGH	660.15	8.97		

EXAMINATION 1Ib

ALL STAFF SALARIES REDUCED BY 10%

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	96.27	-10.02	0.246	1.000
TEACHER AIDE	10.98	-10.01	0.433	1.000
READING SPECIALIST	18.91	-9.94	0.112	1.000
OTHER STAFF	22.32	-10.01	0.078	1.000
STAFF SUBTOTAL	148.49	-10.01	0.235	1.000
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	222.28	-6.85	0.721	1.000
LOW	68.79	-8.87		
1ST QUARTILE	124.45	-7.31		
2ND QUARTILE	169.93	-6.82		
3RD QUARTILE	249.79	-6.46		
HIGH	1309.42	-3.63		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	59.85	-10.00	0.028	1.000
TEACHER AIDE	6.77	-9.97	0.224	1.000
READING SPECIALIST	12.66	-9.92	0.096	1.000
OTHER STAFF	20.46	-10.02	0.084	1.000
STAFF SUBTOTAL	99.74	-9.99	0.035	1.000
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	153.68	-6.63	0.828	0.999
LOW	50.19	-8.85		
1ST QUARTILE	108.08	-7.14		
2ND QUARTILE	134.43	-6.70		
3RD QUARTILE	174.91	-6.17		
HIGH	571.35	-4.06		

EXAMINATION 11c

TEACHER SALARIES INCREASED BY 10%

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	117.71	10.00	0.027	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	175.70	6.41	2.233	0.998
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	249.49	4.28	1.346	0.999
LOW	75.62	0.0		
1ST QUARTILE	139.08	3.33		
2ND QUARTILE	191.72	4.42		
3RD QUARTILE	280.74	5.43		
HIGH	1479.93	6.82		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	73.16	10.00	0.027	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	117.46	6.46	1.968	0.999
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	171.40	4.18	1.079	0.999
LOW	56.09	0.90		
1ST QUARTILE	119.50	3.57		
2ND QUARTILE	150.48	4.20		
3RD QUARTILE	193.72	5.11		
HIGH	639.56	6.33		

EXAMINATION 11d

TEACHER SALARIES REDUCED BY 10%

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	96.27	-10.02	0.246	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	154.26	-6.42	2.267	0.997
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	4.15	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	228.05	-4.29	1.360	0.999
LOW	69.67	-7.22		
1ST QUARTILE	128.65	-5.44		
2ND QUARTILE	173.43	-4.42		
3RD QUARTILE	255.51	-3.34		
HIGH	1313.26	0.0		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	59.85	-10.00	0.028	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	104.15	-6.46	1.969	0.998
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.99	0.0	0.0	1.000
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	158.09	-4.18	1.079	0.999
LOW	51.27	-6.33		
1ST QUARTILE	109.81	-5.11		
2ND QUARTILE	137.98	-4.20		
3RD QUARTILE	181.40	-3.57		
HIGH	591.94	-0.90		

EXAMINATION 11e

SALARIES OF READING SPECIALISTS WHO DID NOT COMPLETE QUESTIONNAIRES INCREASED 10%

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	23.09	9.99	0.068	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	167.10	1.26	1.662	0.999
FACILITIES SUBTOTAL	50.86	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	3.90	-6.46	5.719	0.996
MATERIALS SUBTOTAL	14.05	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	240.63	0.81	1.313	0.999
LOW	73.13	-0.86		
1ST QUARTILE	134.74	-0.07		
2ND QUARTILE	182.56	0.0		
3RD QUARTILE	268.99	1.49		
HIGH	1396.19	6.84		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	15.45	10.00	0.038	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	112.21	1.01	1.524	0.999
FACILITIES SUBTOTAL	32.18	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	2.79	-7.83	6.516	0.998
MATERIALS SUBTOTAL	14.18	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	165.95	0.61	1.188	0.999
LOW	54.27	-0.66		
1ST QUARTILE	114.98	-0.13		
2ND QUARTILE	145.85	-0.02		
3RD QUARTILE	189.68	1.10		
HIGH	614.88	6.51		

EXAMINATION 11f

A DISCOUNT FACTOR OF 5 PERCENT WAS USED

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	165.00	0.0	0.0	1.000
FACILITIES SUBTOTAL	39.82	-21.71	0.053	1.000
EQUIPMENT SUBTOTAL	4.03	-3.06	0.716	1.000
MATERIALS SUBTOTAL	13.23	-5.57	0.657	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	226.80	-4.88	1.294	0.999
LOW	68.45	-8.61		
1ST QUARTILE	128.23	-5.80		
2ND QUARTILE	172.62	-5.09		
3RD QUARTILE	254.35	-3.99		
HIGH	1291.66	-1.38		
DEVELOPMENTAL READING PROGRAMS NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	110.81	0.0	0.0	1.000
FACILITIES SUBTOTAL	25.20	-21.71	0.047	1.000
EQUIPMENT SUBTOTAL	2.91	-3.03	0.857	1.000
MATERIALS SUBTOTAL	13.36	-5.58	0.483	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	156.86	-4.95	1.153	0.999
LOW	51.11	-7.31		
1ST QUARTILE	108.36	-5.78		
2ND QUARTILE	136.90	-4.98		
3RD QUARTILE	179.89	-4.19		
HIGH	585.35	-1.80		

EXAMINATION 11g

THE USEFUL LIFE OF EQUIPMENT IS 30 PERCENT LONGER

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
COMPENSATORY READING PROGRAMS				
NO. OF SCHOOLS	200			
CLASS INSTRUCTOR	107.00	0.0	0.0	1.000
TEACHER AIDE	12.20	0.0	0.0	1.000
READING SPECIALIST	20.99	0.0	0.0	1.000
OTHER STAFF	24.80	0.0	0.0	1.000
STAFF SUBTOTAL	165.00	0.0	0.0	1.000
FACILITIES SUBTOTAL	49.77	-2.13	0.014	1.000
EQUIPMENT SUBTOTAL	3.88	-6.58	1.134	1.000
MATERIALS SUBTOTAL	13.09	-6.63	0.816	1.000
DISTRICT CENTER SUBTOTAL	4.71	0.0	0.0	1.000
TOTAL COST	236.47	-1.03	0.371	1.000
LOW	71.40	-3.37		
1ST QUARTILE	132.27	-1.20		
2ND QUARTILE	180.70	-1.00		
3RD QUARTILE	264.70	-0.79		
HIGH	1382.09	-0.25		
DEVELOPMENTAL READING PROGRAMS				
NO. OF SCHOOLS	140			
CLASS INSTRUCTOR	66.50	0.0	0.0	1.000
TEACHER AIDE	7.52	0.0	0.0	1.000
READING SPECIALIST	14.05	0.0	0.0	1.000
OTHER STAFF	22.73	0.0	0.0	1.000
STAFF SUBTOTAL	110.81	0.0	0.0	1.000
FACILITIES SUBTOTAL	31.50	-2.13	0.019	1.000
EQUIPMENT SUBTOTAL	2.82	-6.42	1.479	0.999
MATERIALS SUBTOTAL	13.21	-6.78	0.597	1.000
DISTRICT CENTER SUBTOTAL	4.57	0.0	0.0	1.000
TOTAL COST	162.91	-1.17	0.430	1.000
LOW	52.83	-2.96		
1ST QUARTILE	113.06	-1.33		
2ND QUARTILE	142.32	-1.12		
3RD QUARTILE	185.61	-0.88		
HIGH	810.96	-0.31		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12a
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
DIAGNOSTIC TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	15.79	6.00	0.037	0.999
TEACHER AIDE	5.24	5.74	0.809	1.000
READING SPECIALIST	29.90	6.00	0.347	1.000
OTHER STAFF	15.52	1.32	1.879	0.999
STAFF SUBTOTAL	17.91	5.35	0.647	0.999
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	1.68	0.0	0.0	1.000
MATERIALS SUBTOTAL	2.46	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	10.60	0.0	0.0	1.000
TOTAL COST	14.82	4.33	0.676	0.999
LOW	7.55	1.53		
1ST QUARTILE	12.07	3.96		
2ND QUARTILE	13.94	4.44		
3RD QUARTILE	16.54	4.77		
HIGH	30.90	5.95		
STAFF DEVELOPMENT TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	0.68	0.0	0.0	1.000
TEACHER AIDE	0.79	0.0	0.0	1.000
READING SPECIALIST	8.71	6.18	1.089	1.000
OTHER STAFF	12.46	0.77	1.395	0.999
STAFF SUBTOTAL	4.58	2.75	1.869	0.999
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	11.17	0.0	0.0	1.000
TOTAL COST	5.50	1.51	1.240	0.999
LOW	1.75	0.0		
1ST QUARTILE	3.88	0.59		
2ND QUARTILE	4.84	1.34		
3RD QUARTILE	5.99	2.10		
HIGH	14.29	5.77		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12a
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
INSTRUCTION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	73.60	5.86	0.020	1.000
TEACHER AIDE	84.52	5.58	0.859	1.000
READING SPECIALIST	51.48	5.61	0.626	1.000
OTHER STAFF	12.01	1.50	2.352	1.000
STAFF SUBTOTAL	59.72	5.70	0.218	1.000
FACILITIES SUBTOTAL	64.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	97.32	0.0	0.0	1.000
MATERIALS SUBTOTAL	97.53	0.0	0.0	1.003
DISTRICT CENTER SUBTOTAL	41.05	0.0	0.0	1.000
TOTAL COST	63.91	3.53	0.474	0.998
LOW	41.15	1.80		
1ST QUARTILE	60.53	3.26		
2ND QUARTILE	65.43	3.52		
3RD QUARTILE	68.41	3.86		
HIGH	84.41	4.82		
ADMINISTRATION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	9.93	-33.35	0.043	1.001
TEACHER AIDE	9.46	-33.36	0.137	1.000
READING SPECIALIST	9.92	-33.35	0.062	1.000
OTHER STAFF	60.01	-2.60	5.223	0.998
STAFF SUBTOTAL	17.79	-20.46	5.548	0.997
FACILITIES SUBTOTAL	14.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	37.19	0.0	0.0	1.000
TOTAL COST	15.77	-16.19	4.208	0.991
LOW	6.27	-28.89		
1ST QUARTILE	13.19	-18.82		
2ND QUARTILE	14.57	-16.17		
3RD QUARTILE	17.63	-13.24		
HIGH	41.78	-4.06		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12b
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
DIAGNOSTIC TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	19.96	33.34	0.039	1.000
TEACHER AIDE	4.94	0.0	0.0	1.000
READING SPECIALIST	28.21	0.0	0.0	1.000
OTHER STAFF	15.23	0.0	0.0	1.000
STAFF SUBTOTAL	19.67	16.91	7.275	0.965
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	1.68	0.0	0.0	1.000
MATERIALS SUBTOTAL	2.46	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	10.60	0.0	0.0	1.000
TOTAL COST	15.96	13.33	5.159	0.982
LOW	9.04	0.0		
1ST QUARTILE	13.58	9.07		
2ND QUARTILE	15.31	12.96		
3RD QUARTILE	17.76	17.17		
HIGH	30.72	25.21		
STAFF DEVELOPMENT TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	0.68	0.0	0.0	1.000
TEACHER AIDE	0.79	0.0	0.0	1.000
READING SPECIALIST	8.18	0.0	0.0	1.000
OTHER STAFF	12.37	0.0	0.0	1.000
STAFF SUBTOTAL	4.45	0.0	0.0	1.000
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	11.17	0.0	0.0	1.000
TOTAL COST	5.41	0.0	0.0	1.000
LOW	1.75	0.0		
1ST QUARTILE	3.84	0.0		
2ND QUARTILE	4.77	0.0		
3RD QUARTILE	5.89	0.0		
HIGH	14.23	0.0		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12b
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
INSTRUCTION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	64.54	-7.14	0.023	1.000
TEACHER AIDE	80.06	0.0	0.0	1.000
READING SPECIALIST	48.70	0.0	0.0	1.000
OTHER STAFF	11.57	0.0	0.0	1.000
STAFF SUBTOTAL	53.83	-4.71	1.403	0.988
FACILITIES SUBTOTAL	64.99	0.0	0.0	2.566
EQUIPMENT SUBTOTAL	97.32	0.0	0.0	1.000
MATERIALS SUBTOTAL	97.53	0.0	0.0	1.003
DISTRICT CENTER SUBTOTAL	41.05	0.0	0.0	1.000
TOTAL COST	59.98	-2.85	0.732	0.994
LOW	38.92	-4.46		
1ST QUARTILE	56.93	-3.38		
2ND QUARTILE	61.55	-2.85		
3RD QUARTILE	64.25	-2.31		
HIGH	81.09	0.0		
ADMINISTRATION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.82	0.0	0.0	1.000
TEACHER AIDE	14.20	0.0	0.0	1.000
READING SPECIALIST	14.89	0.0	0.0	1.000
OTHER STAFF	60.82	0.0	0.0	1.000
STAFF SUBTOTAL	22.02	0.0	0.0	1.000
FACILITIES SUBTOTAL	14.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	37.19	0.0	0.0	1.000
TOTAL COST	18.65	0.0	0.0	1.000
LOW	8.10	0.0		
1ST QUARTILE	16.16	0.0		
2ND QUARTILE	17.61	0.0		
3RD QUARTILE	20.03	0.0		
HIGH	43.55	0.0		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12c
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
DIAGNOSTIC TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.90	0.0	0.0	1.000
TEACHER AIDE	4.94	0.0	0.0	1.000
READING SPECIALIST	28.72	0.86	3.405	0.991
OTHER STAFF	15.23	0.0	0.0	1.000
STAFF SUBTOTAL	17.10	0.33	1.599	0.993
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	1.68	0.0	0.0	1.000
MATERIALS SUBTOTAL	2.46	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	10.60	0.0	0.0	1.000
TOTAL COST	14.26	0.29	1.472	0.993
LOW	7.22	0.0		
1ST QUARTILE	11.58	0.0		
2ND QUARTILE	13.39	0.0		
3RD QUARTILE	15.90	0.0		
HIGH	32.80	12.07		
STAFF DEVELOPMENT TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	0.68	0.0	0.0	1.000
TEACHER AIDE	0.79	0.0	0.0	1.000
READING SPECIALIST	8.18	0.0	0.0	1.000
OTHER STAFF	12.37	0.0	0.0	1.000
STAFF SUBTOTAL	4.45	0.0	0.0	1.000
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	11.17	0.0	0.0	1.000
TOTAL COST	5.41	0.0	0.0	1.000
LOW	1.75	0.0		
1ST QUARTILE	3.84	0.0		
2ND QUARTILE	4.77	0.0		
3RD QUARTILE	5.89	0.0		
HIGH	14.23	0.0		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12c
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
INSTRUCTION TASK				
NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	69.52	0.0	0.0	1.000
TEACHER AIDE	80.06	0.0	0.0	1.000
READING SPECIALIST	48.21	-3.09	11.41	0.994
OTHER STAFF	11.57	0.0	0.0	1.000
STAFF SUBTOTAL	56.41	-0.24	1.517	0.996
FACILITIES SUBTOTAL	64.99	0.0	0.0	2.566
EQUIPMENT SUBTOTAL	97.32	0.0	0.0	1.000
MATERIALS SUBTOTAL	97.53	0.0	0.0	1.003
DISTRICT CENTER SUBTOTAL	41.05	0.0	0.0	1.000
TOTAL COST	61.68	-0.13	0.796	0.997
LOW	36.84	-7.85		
1ST QUARTILE	58.56	0.0		
2ND QUARTILE	63.31	0.0		
3RD QUARTILE	65.93	0.0		
HIGH	82.92	0.0		
ADMINISTRATION TASK				
NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.90	0.0	0.0	1.000
TEACHER AIDE	14.20	0.0	0.0	1.000
READING SPECIALIST	14.89	0.0	0.0	1.000
OTHER STAFF	60.82	0.0	0.0	1.000
STAFF SUBTOTAL	22.02	0.0	0.0	1.000
FACILITIES SUBTOTAL	14.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	37.19	0.0	0.0	1.000
TOTAL COST	18.65	0.0	0.0	1.000
LOW	8.10	0.0		
1ST QUARTILE	16.16	0.0		
2ND QUARTILE	17.61	0.0		
3RD QUARTILE	20.03	0.0		
HIGH	43.55	0.0		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12d
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
DIAGNOSTIC TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.90	0.0	0.0	1.000
TEACHER AIDE	4.94	0.0	0.0	1.000
READING SPECIALIST	28.21	0.0	0.0	1.000
OTHER STAFF	15.23	0.0	0.0	1.000
STAFF SUBTOTAL	17.00	0.0	0.0	1.000
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	1.68	0.0	0.0	1.000
MATERIALS SUBTOTAL	2.46	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	10.60	0.0	0.0	1.000
TOTAL COST	14.20	0.0	0.0	1.000
LOW	7.22	0.0		
1ST QUARTILE	11.58	0.0		
2ND QUARTILE	13.32	0.0		
3RD QUARTILE	15.90	0.0		
HIGH	29.33	0.0		
STAFF DEVELOPMENT TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	0.68	0.0	0.0	1.000
TEACHER AIDE	0.79	0.0	0.0	1.000
READING SPECIALIST	8.36	0.64	3.484	0.991
OTHER STAFF	12.37	0.0	0.0	1.000
STAFF SUBTOTAL	4.49	0.37	2.376	0.995
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	11.17	0.0	0.0	1.000
TOTAL COST	5.44	0.29	1.873	0.996
LOW	1.75	0.0		
1ST QUARTILE	3.84	0.0		
2ND QUARTILE	4.77	0.0		
3RD QUARTILE	5.89	0.0		
HIGH	14.23	15.81		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12d
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
INSTRUCTION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	69.52	0.0	0.0	1.000
TEACHER AIDE	80.06	0.0	0.0	1.000
READING SPECIALIST	48.54	-0.71	3.957	0.999
OTHER STAFF	11.57	0.0	0.0	1.000
STAFF SUBTOTAL	56.46	-0.08	0.497	0.999
FACILITIES SUBTOTAL	64.99	0.0	0.0	2.566
EQUIPMENT SUBTOTAL	97.32	0.0	0.0	1.000
MATERIALS SUBTOTAL	97.53	0.0	0.0	1.003
DISTRICT CENTER SUBTOTAL	41.05	0.0	0.0	1.000
TOTAL COST	61.71	-0.05	0.302	0.999
LOW	39.98	-2.40		
1ST QUARTILE	58.52	0.0		
2ND QUARTILE	63.28	0.0		
3RD QUARTILE	66.04	0.0		
HIGH	82.92	0.0		
ADMINISTRATION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.90	0.0	0.0	1.000
TEACHER AIDE	14.20	0.0	0.0	1.000
READING SPECIALIST	14.89	0.0	0.0	1.000
OTHER STAFF	60.82	0.0	0.0	1.000
STAFF SUBTOTAL	22.02	0.0	0.0	1.000
FACILITIES SUBTOTAL	14.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	37.19	0.0	0.0	1.000
TOTAL COST	18.65	0.0	0.0	1.000
LOW	8.10	0.0		
1ST QUARTILE	16.16	0.0		
2ND QUARTILE	17.61	0.0		
3RD QUARTILE	20.03	0.0		
HIGH	43.55	0.0		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12e
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
DIAGNOSTIC TASK				
NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.90	0.0	0.0	1.000
TEACHER AIDE	4.94	0.0	0.0	1.000
READING SPECIALIST	28.21	0.0	0.0	1.000
OTHER STAFF	35.12	26.17	32.41	0.510
STAFF SUBTOTAL	18.15	6.82	7.886	0.950
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	1.68	0.0	0.0	1.000
MATERIALS SUBTOTAL	2.46	0.0	0.0	1.000
DISTRICT CENTER SUBTOTAL	10.60	0.0	0.0	1.000
TOTAL COST	14.74	3.72	4.695	0.975
LOW	7.22	-2.34		
1ST QUARTILE	12.02	1.58		
2ND QUARTILE	13.80	2.32		
3RD QUARTILE	16.39	4.17		
HIGH	30.54	45.05		
STAFF DEVELOPMENT TASK				
NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	0.68	0.0	0.0	1.000
TEACHER AIDE	0.79	0.0	0.0	1.000
READING SPECIALIST	8.18	0.0	0.0	1.000
OTHER STAFF	22.10	-4.86	34.80	0.372
STAFF SUBTOTAL	3.64	-27.74	14.62	0.944
FACILITIES SUBTOTAL	9.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	11.17	0.0	0.0	1.000
TOTAL COST	4.96	-9.45	9.767	0.958
LOW	1.68	-57.89		
1ST QUARTILE	3.36	-12.01		
2ND QUARTILE	4.24	-6.28		
3RD QUARTILE	5.50	-2.89		
HIGH	14.42	1.73		

STUDY OF COMPENSATORY READING PROGRAMS
SUMMARY OF AVERAGE READING COSTS PER STUDENT
SENSITIVITY ANALYSIS OF TEST 12e
FOR SCHOOLS IN ALL CLUSTERS

	----ALL SOURCES-- NEW-M	%DIF	S.D.	R**2
INSTRUCTION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	69.52	0.0	0.0	1.000
TEACHER AIDE	80.06	0.0	0.0	1.000
READING SPECIALIST	48.70	0.0	0.0	1.000
OTHER STAFF	23.95	-0.97	21.42	0.799
STAFF SUBTOTAL	62.90	12.09	17.62	0.662
FACILITIES SUBTOTAL	64.99	0.0	0.0	2.566
EQUIPMENT SUBTOTAL	97.32	0.0	0.0	1.000
MATERIALS SUBTOTAL	97.53	0.0	0.0	1.003
DISTRICT CENTER SUBTOTAL	41.05	0.0	0.0	1.000
TOTAL COST	66.36	7.84	6.851	0.703
LOW	47.68	0.0		
1ST QUARTILE	64.14	3.88		
2ND QUARTILE	67.40	5.73		
3RD QUARTILE	69.99	9.03		
HIGH	82.92	56.69		
ADMINISTRATION TASK NO. OF SCHOOLS	203			
CLASS INSTRUCTOR	14.90	0.0	0.0	1.000
TEACHER AIDE	14.20	0.0	0.0	1.000
READING SPECIALIST	14.89	0.0	0.0	1.000
OTHER STAFF	18.83	-73.92	89.21	0.022
STAFF SUBTOTAL	15.29	-28.15	53.41	0.159
FACILITIES SUBTOTAL	14.99	0.0	0.0	1.000
EQUIPMENT SUBTOTAL	0.0	0.0	0.0	0.0
MATERIALS SUBTOTAL	0.0	0.0	0.0	0.0
DISTRICT CENTER SUBTOTAL	37.19	0.0	0.0	1.000
TOTAL COST	13.94	-23.23	31.45	0.295
LOW	8.10	-57.31		
1ST QUARTILE	12.97	-29.35		
2ND QUARTILE	13.71	-21.12		
3RD QUARTILE	14.48	-15.71		
HIGH	22.47	0.0		